How to Machine Gray Iron

PAGE 137

Ceramic tools pay off on short runs

PAGE 130

American Machinist

MAY 20, 1957 PRICE 50 CENTS

Automatic bonding machine assembles transmisson parts — see page 2

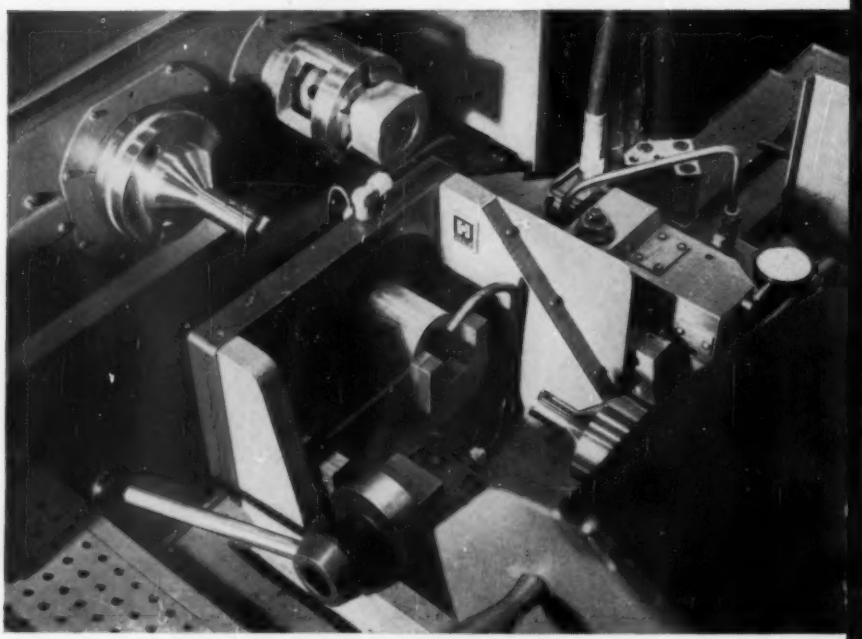
IN ANY MACHINE TOOL OPERATION,

where do you look for the PAY-OFF ?

- ☐ On the machine itself
- ☐ In subsequent assembly operations
- ☐ In the finished product

On a Heald BORE-MATIC, pay-off time at the machine is only the beginning!

For example: A manufacturer of portable tools purchased the Model 222 Bore-Matic shown here, for boring and facing various sizes of tool housings. Although results showed a worthwhile time saving of about 20%, this alone was hardly enough to justify the cost of the machine. But analysis of subsequent assembly operations some time later showed substantially reduced assembly times which *fully justified the investment.* Although average Borizing time is only 1 or 2 minutes per piece, the assembly operations take from 30 minutes to 2½ hours and involve as many as five pieces that now fit exactly right because they've been through the Bore-Matic. However, the customer reports that the *major* advantage of the machine is improvement in quality of the finished product. Under previous methods, frequent trouble was encountered due to distortion of metal from improper clamping and locating. So this Heald Bore-Matic not only saved machine time and cut production costs, but also contributed to a *better* and *more saleable* product.



THE *precision production* that you get from a Heald Bore-Matic or Internal Grinder is not an end in itself. Actually, it's the start of a chain reaction that will be felt in subsequent assembly operations and even in the performance and saleability of the finished product as well.

When you measure the length of time it will take for a machine to pay for itself, it's important to look at the *overall* picture. Take the savings you get at the machine. Add the savings from reduced assembly time. And if you can put a dollar value on the resulting improvement in product quality, add this too. You'll find that . . .

IT PAYS TO COME TO HEALD

HEALD

THE HEALD MACHINE COMPANY

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VOLUME 101, NUMBER 10

The "give-'em-hell" approach to stainless . . . You can get better finish and lower cost if you forget tool life. *By Art Quinlan, Ryan Aeronautical Co.* **121**

On the job balancing . . . is possible with portable machine developed at naval shipyard. *By Jose Arzaga* **123**

Missile gears are held to ± 5 seconds . . . Here is how the gear-cutting method was chosen, the blanks prepared, and the gears inspected for a guidance-control system. *By Roland E Gagon, Northrop Aircraft, Inc.* **124**

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Carbide inserts plus automatic lapping equal minimum tool cost . . . Lapping 54 tools at a time gives a lower cost per cutting edge. *By W C Thuerwachter, Giddings & Lewis Machine Tool Co.* **162**

SPECIAL REPORT NUMBER 444

How to machine gray and nodular iron . . . A practical guide to the machining of cast iron that deals with tool grinding, machinability, the cost of machining, and provides specific machining recommendations. *By Norman Zlatin, W H Friedlander, and Charles F Walton* **137**

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Tolerances and Limits, XIII, XIV, XV . . . Here are questions raised by our publication of this tentative standard with answers provided by a member of the committee that drafted the standard **171**

American Machinist *Chips*

Cover . . .
Chevrolet transmission parts are bonded automatically in an assembly machine built by Modern Industrial Engineering Co. Details on the machine are in the story on page 192.

Tool-life contrast . . . With our usual interest in presenting all sides of a technical controversy, we are happy to combine in this issue two widely differing points of view toward tool life. One says concentrate on maximum tool life and the other says forget tool life. We think that both views are logical for the circumstances that apply and conclude that you can't operate efficiently if you always run in the same rut.

Even the conventional view, however, is presented in the most modern dress. Many years ago Dr Schlesinger reported in our pages his then startling view that machinability depends on microstructure rather than on hardness. This view is now generally accepted. Some years later the Curtiss-Wright Corp produced the Air Force Machinability Reports building up the concept of maximum tool life on the foundation of microstructure. The research for these reports was done by Met-Cut Research.

From this background it is only a short step to the Special Report on the machining of gray and nodular iron that is published in this issue. Back in 1951, when Anderson Ashburn, then an associate editor, was starting his investigations of cast iron that eventually wound up in our book, "How to Work Metals," he learned that the Gray Iron Founders' Society had started a research project on machining cast iron as a part of its forthcoming handbook. Andy sought permission to publish it. The job is now completed and you'll find most of it in the Special Report on page 137. The report combines the experience of the members of the society and the work of Met-Cut Research.

At the other extreme is the advice of Art Quinlan, Ryan Aeronautical Co, that you forget tool life when you machine stainless. For Ryan, at least, the result was better finish and lower cost. See page 121.

Excitement has also been stirred by our advance publication of the series of Reference Book Sheets on the tentative standards for tolerances and limits. You'll find some of the questions that have been raised and the views of a member of the committee that drafted the standards starting on page 171.

Coming . . . *AM* for June 3 will bring to your desk a broad array of new shop techniques, including a timely discussion of angles for oxide tools and a concise report on production trepanning by the experts at Watervliet Arsenal. You'll find articles, too, describing a templet-controlled miller, use of extruded shapes to speed output, techniques for working tool steel, and a scientific but simple approach to shop cost accounting.

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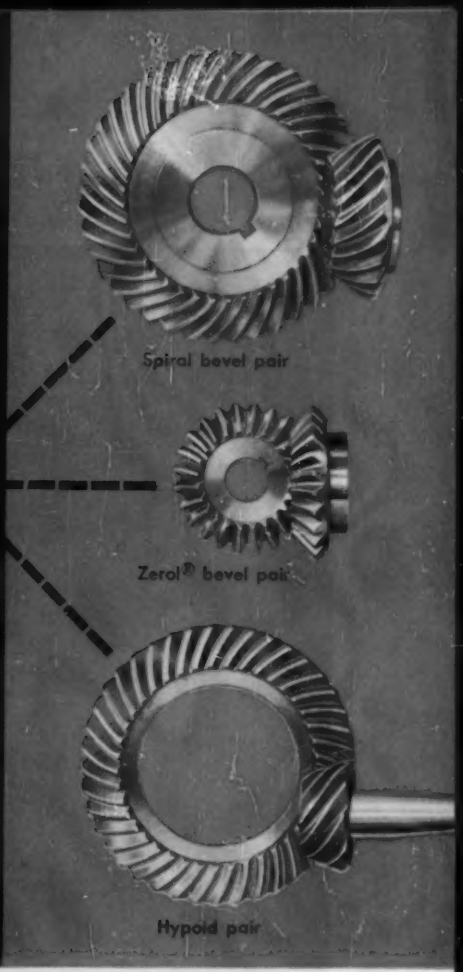

One cutter produced these three gear pairs!

The new Gleason No. 116 Hypoid Generator used *one* Unitool* Cutter to generate the three gear pairs shown above. Only five additional Unitool Cutters are needed on this generator to cut spiral and Zerol® bevel gears of any ratio, and hypoid gears of 3:1 ratio and higher; up to 18″ pitch diameter.

The Unitool Method was developed especially for use with the No. 116 Hypoid Generator, and its smaller counterpart, the No. 106 Hypoid Generator. This new method requires only a small tooling cost to cover the entire range of both machines.

It is intended for the production of small quantities of bevel and hypoid gears, and does not replace the cutting methods now in use for mass production. When using these methods, the No. 116 Generator is substantially faster than previous models.

In addition, the new features incorporated on the No. 116 offer simplification of tooth bearing development, improved quality, and much easier setup and operation.

We shall be glad to send more information on the No. 116 Hypoid Generator and the Unitool Method for producing small quantities of bevel gears.

** Trademark*

The No. 116 Hypoid Generator cuts spiral bevel, Zerol bevel and hypoid gears up to 18″ pitch diameter, any ratio up to 10:1, any pitch 2 DP and finer.

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Builders of bevel gear machinery for over 90 years

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Inside Story of a

CINCINNATI

MILLING MACHINES • BROACHING MACHINES • CUTTER AND TOOL GRINDERS • METAL FORMING MACHINES

Smart Buy for Your Shop . . .

It's a good idea to look "under the hood" when buying machine tools. Hidden features may give you some real clues to the machine's potential for your particular objectives. A quick look "under the hood" of CINCINNATI® ML and MI Milling Machines reveals a host of features that work unseen toward the common goal of every shop . . . to reduce the cost of production. Six features are illustrated below. Of course, there are many more, such as:

Automatic lubricating systems for column and knee reduce preventive maintenance

Knee and column oil filters may be removed from outside machine

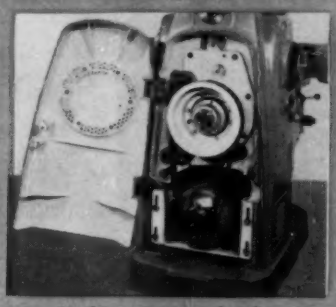
Hydraulic shifting of spindle drive gears gives the operator an assist

Live power rapid traverse at the rate of 150" per min. aids the setup man

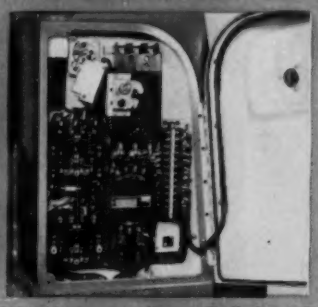
Big selection of standard attachments

CINCINNATI ML and MI Milling Machines are unquestionably a smart buy for your shop. Would you like to have more information about these machines? For brief data look in Sweet's Machine Tool File. Or, for complete specifications, write for a copy of catalog No. M-1916-1.

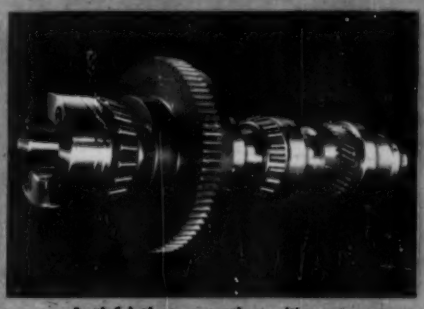
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO



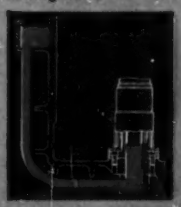
Cradle type mounting for spindle drive motor greatly simplifies removal and servicing of the motor.



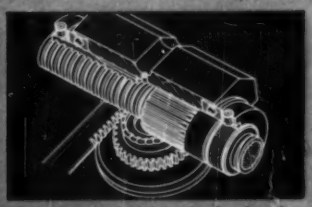
Electrical controls are built-in and completely enclosed for protection against accidental damage, dust and cutting fluid.



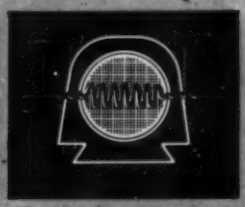
Anti-friction mounting with center support for the heavy spindle assembly, smoothly transmits maximum cutting power.



Vertical screw is submerged in a bath of oil from its own reservoir, assuring long, accurate life.



Automatic backlash device increases productivity. Machine can mill equally well as the table feeds to the right, left or alternately right and left.



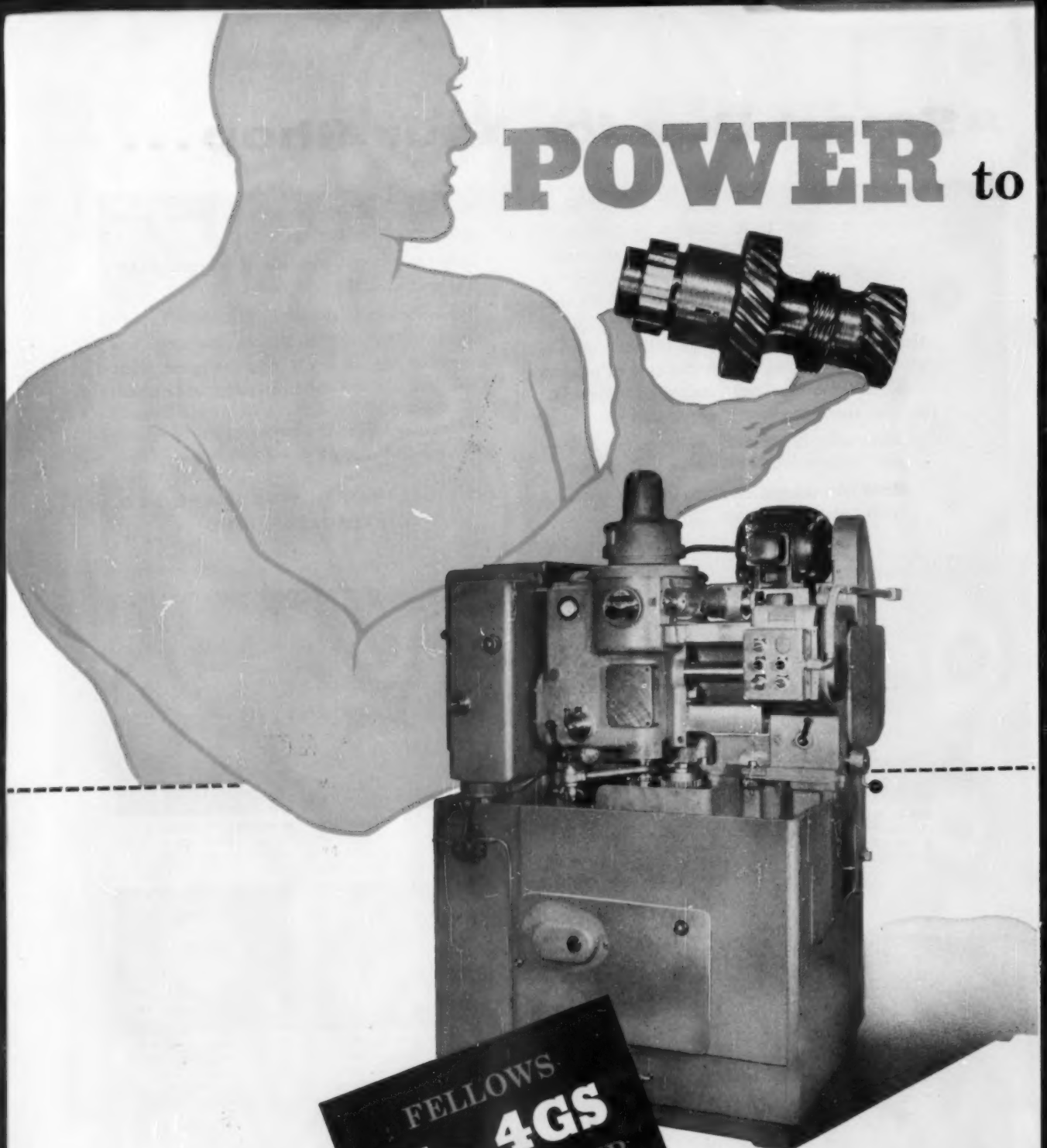
Dynapoise overarm smooths out the cutting action; provides straight-edge alignment for arbor supports.

Brief Specs CINCINNATI ML and MI Milling Machines

Size	No. 2 ML		No. 2MI			No. 3MI	
Style	Plain	Univ.	Plain	Univ.	Vert.	Plain	Univ.
Range: Longitudinal	28"	28"	28"	28"	28"	34"	34"
Cross	10"	10"	10"	10"	12"	12"	12"
Vertical	16½"	16"	19"	18"	14"	20"	19"
Sixteen Spindle Speeds	25-1500 rpm all sizes and styles (higher and lower ranges optional)						
Sixteen Feeds	¼-30" per min., all sizes and styles						
Motor Drive: Spindle	3 hp	3 hp	5 hp	5 hp	5 hp	7½ hp	7½ hp

HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID • GRINDING WHEELS

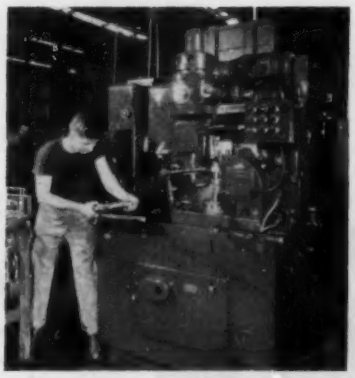
POWER to



FELLOWS
No. 4GS
GEAR SHAPER

THE
PRECISION
LINE

Lower Gear Production Costs



Performance figures of Fellows No. 4GS Gear Shapers on many production lines prove that these high speed machines pay "profits" in lowered costs everywhere they're used. One major manufacturer has installed 10 new No. 4GS Gear Shapers because each cuts 30% faster than his older machines, saves in set-up time, too.

The new Fellows No. 4GS Gear Shaper finish-cuts internal and external spurs and helicals up to 6" P.D. and 2" face width, at 9 cutter speeds from 98 to 635 strokes per minute. Rigid mechanism assures close tolerances at all speeds. For large production runs, it can be readily adapted to operate semi-automatically or completely automatically. And the versatility of the No. 4GS Gear Shaper permits fast, efficient cutting of a nearly infinite variety of cams, splines and special contours.

For full information about the complete Precision Line of Fellows Gear Production and Inspection Equipment, get in touch with your Fellows representative. Write, wire or phone any Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Ave., Royal Oak, Michigan
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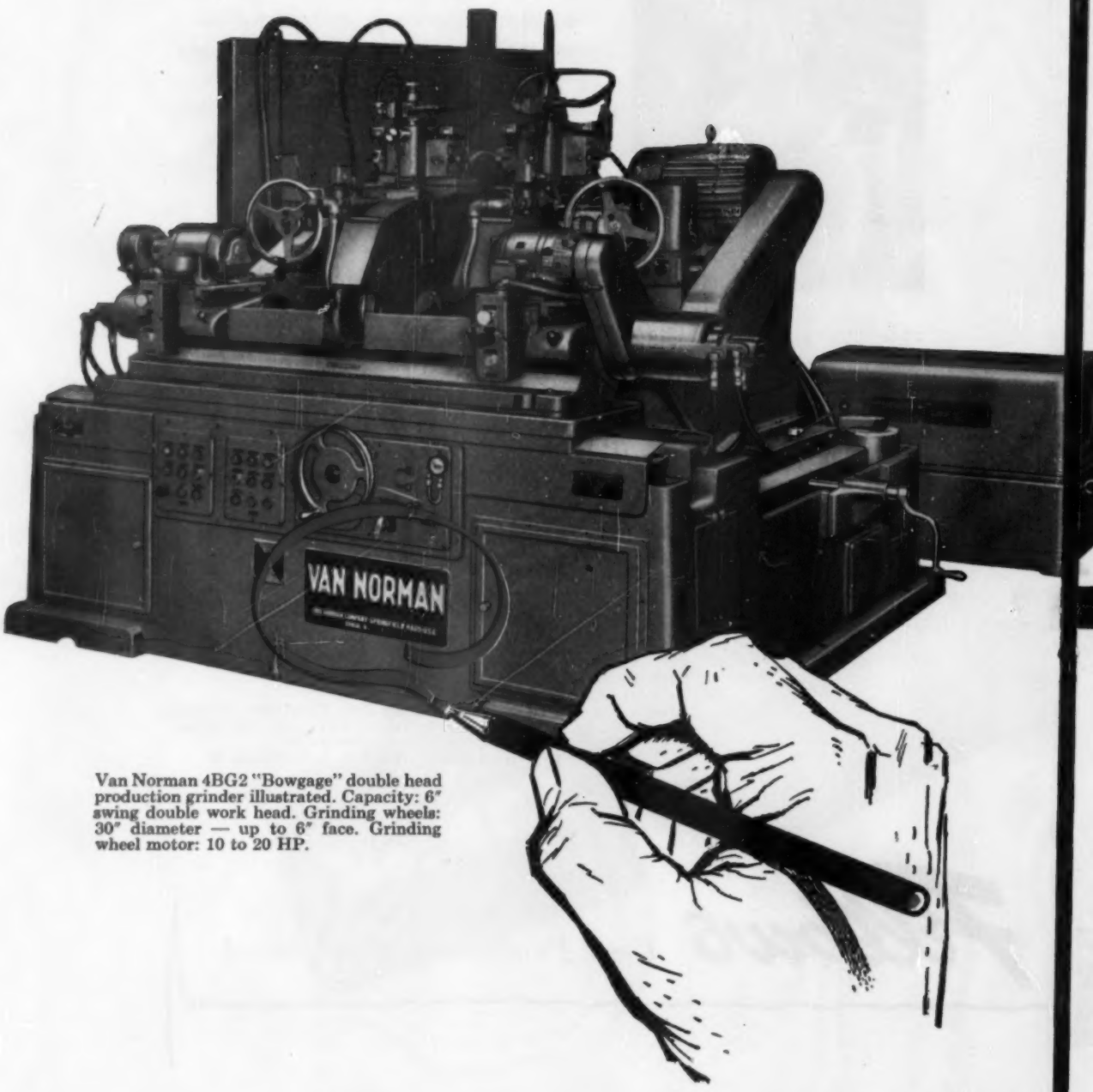
Fellows *Gear Production Equipment*

The Accent is on

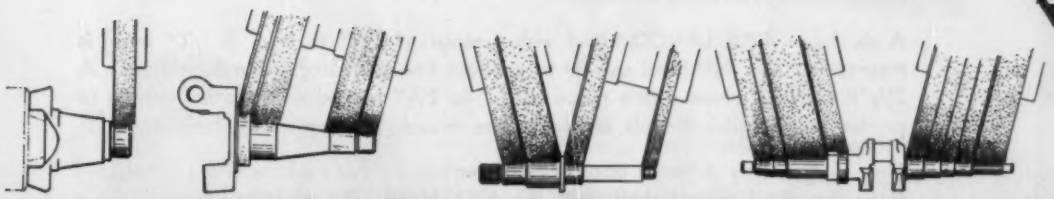


Van Norman 4BG2 "Bowgage" double head production grinder illustrated. Capacity: 6" swing double work head. Grinding wheels: 30" diameter — up to 6" face. Grinding wheel motor: 10 to 20 HP.

Production

when you use a

VAN NORMAN "BOWGAGE" PRODUCTION GRINDER



Here are sketches of several actual applications performed for users of single and double head Bowgage Production grinding machines.

"Engineered for the job," the Van Norman 4BG "Bowgage" Production Grinder gives you accurate, fast, economical mass production.

Actual case histories on these massive grinders continually show substantial savings by keeping production up and costs down.

Van Norman production grinders can help you with your mass production problems. Write, wire or telephone, today, for complete details on the Van Norman 4BG "Bowgage" Production Grinders.

Don't wait . . . for extra profit install a Van Norman "Bowgage" Production Grinder now! They are available in many purchase plans . . . Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate up to 10 years. Conditional Sales Contracts not available to Export.

VAN NORMAN MACHINE COMPANY

SPRINGFIELD 7, MASSACHUSETTS

A DIVISION OF VAN NORMAN INDUSTRIES, INC.

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

3/4"- 4.320" threading range

. . . with one LANDMACO Machine

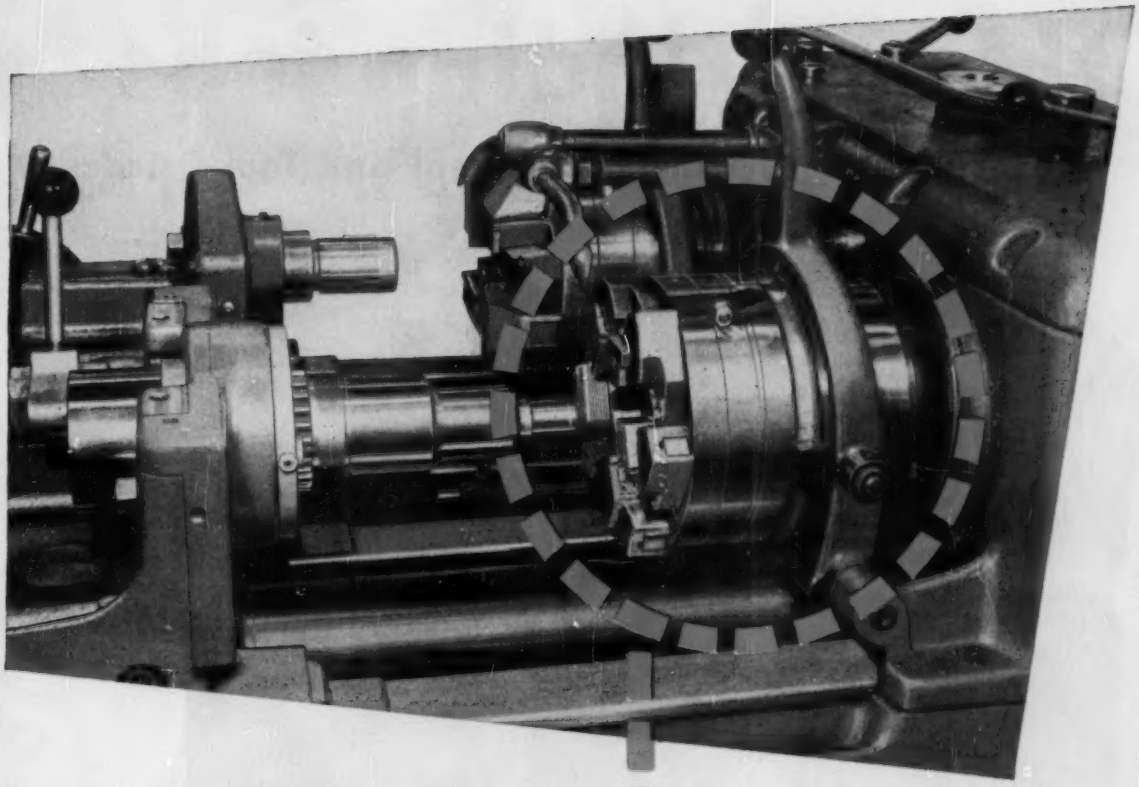
The Twin Disc Clutch Company Hydraulic Division in Rockford, Illinois, is able to thread a wide variety of work from 3/4"-32 pitch to 4.320"-12 pitch with just one LANDMACO Threading Machine.

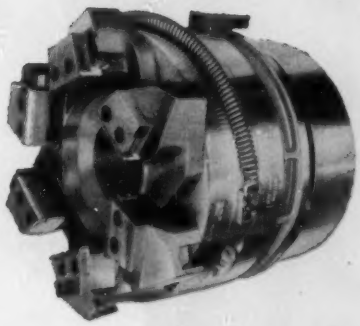
A six-chaser 40RX LANCO Head with a range of 2½" to 9¼" (5-1/8" bore) is mounted on the right-hand spindle to produce fine-pitch large-diameter threads. A 2½"R LANCO Head with a range of ½" to 2½" is used on the other spindle to produce coarse-pitch threads, small-diameter threads, and long thread lengths.

One of the many different operations performed by this equipment is illustrated—threading clutch output shafts with the 40RX Head. The workpiece is made from C1045 steel, heat-treated to 229-269 Brinnell hardness. A special 12-pitch UN Thread, with a 3.669"-3.676" pitch-diameter tolerance, is cut .830" long to within ¼" of the shoulder. 15 pieces are threaded per hour, including 100% inspection by gauging on the machine. Even with heat-treated material and exacting thread finish requirements, 100 pieces are completed between chaser grinds.

The different types of special workholding fixtures designed for these short-run operations at Twin Disc are a major factor in the versatility of the equipment used. For example, in the operation illustrated, a special carriage front allows this LANDMACO Machine to thread a workpiece with a diameter well beyond its normal range. These special fixtures may be used interchangeably with the standard vises.

This installation shows how LANDIS Equipment and Engineering can combine to economically solve a problem in Thread Production. May we suggest the most efficient method for producing your Threads?





For additional information:

* on the many types and styles of LANDIS Die Heads, ask for Bulletins F-80 or F-90
* on LANDMACO THREADING Machines, ask for Bulletin H-76.

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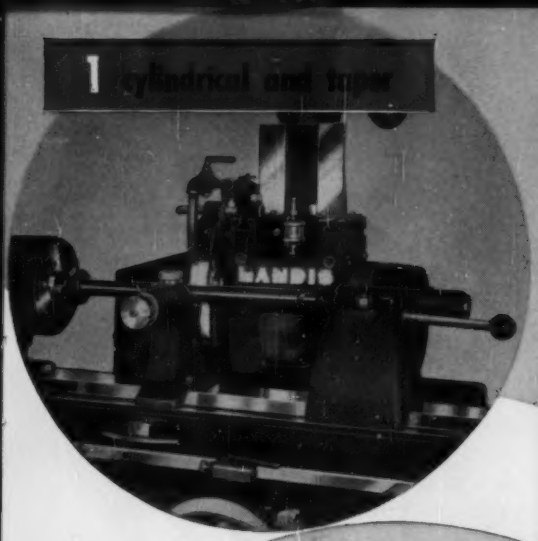
One Machine for all these grinding jobs

Landis Universal and Tool Grinder

Landis 12" x 28" Universal and Tool Grinder —two machines in one—a tool grinder and a universal grinder. Catalog K - 53

LANDIS
precision grinders

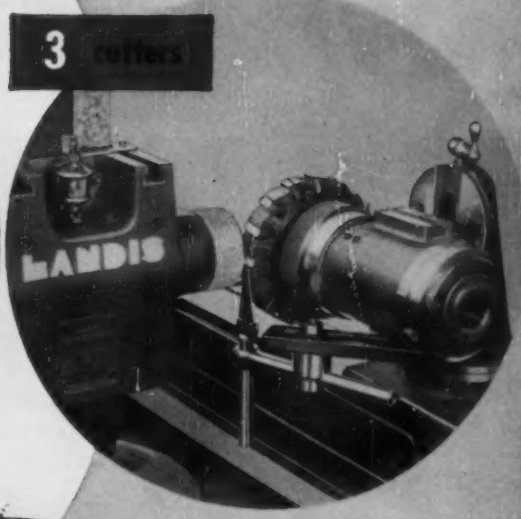
LANDIS TOOL COMPANY / WAYNESBORO, PENNA.

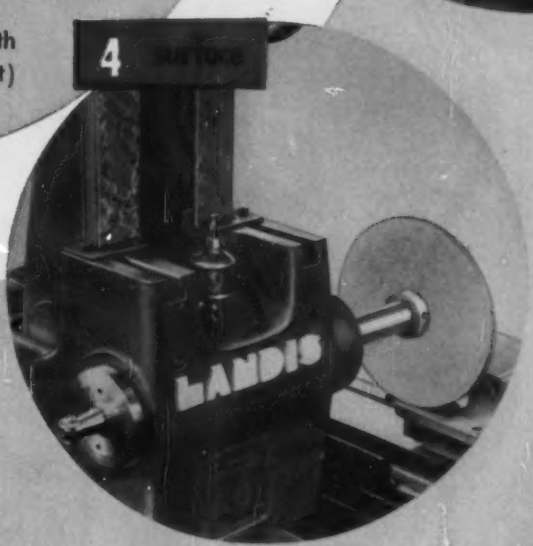


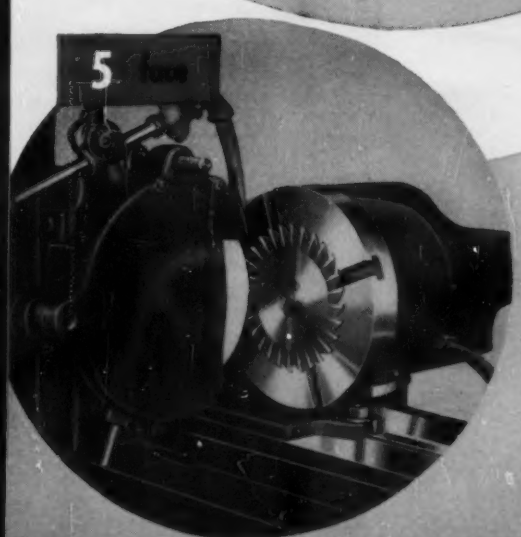
Also sharpens these tools:

- Taps
- Formed cutters
- Spiral mills
- Milling cutters
- Hobs
- Forming tools
- Gear cutters
- Face mills
- End mills
- Drills
- Saws
- Reamers

(All operations can be done with standard and extra equipment)







Giddings & Lewis

MODEL

350-T

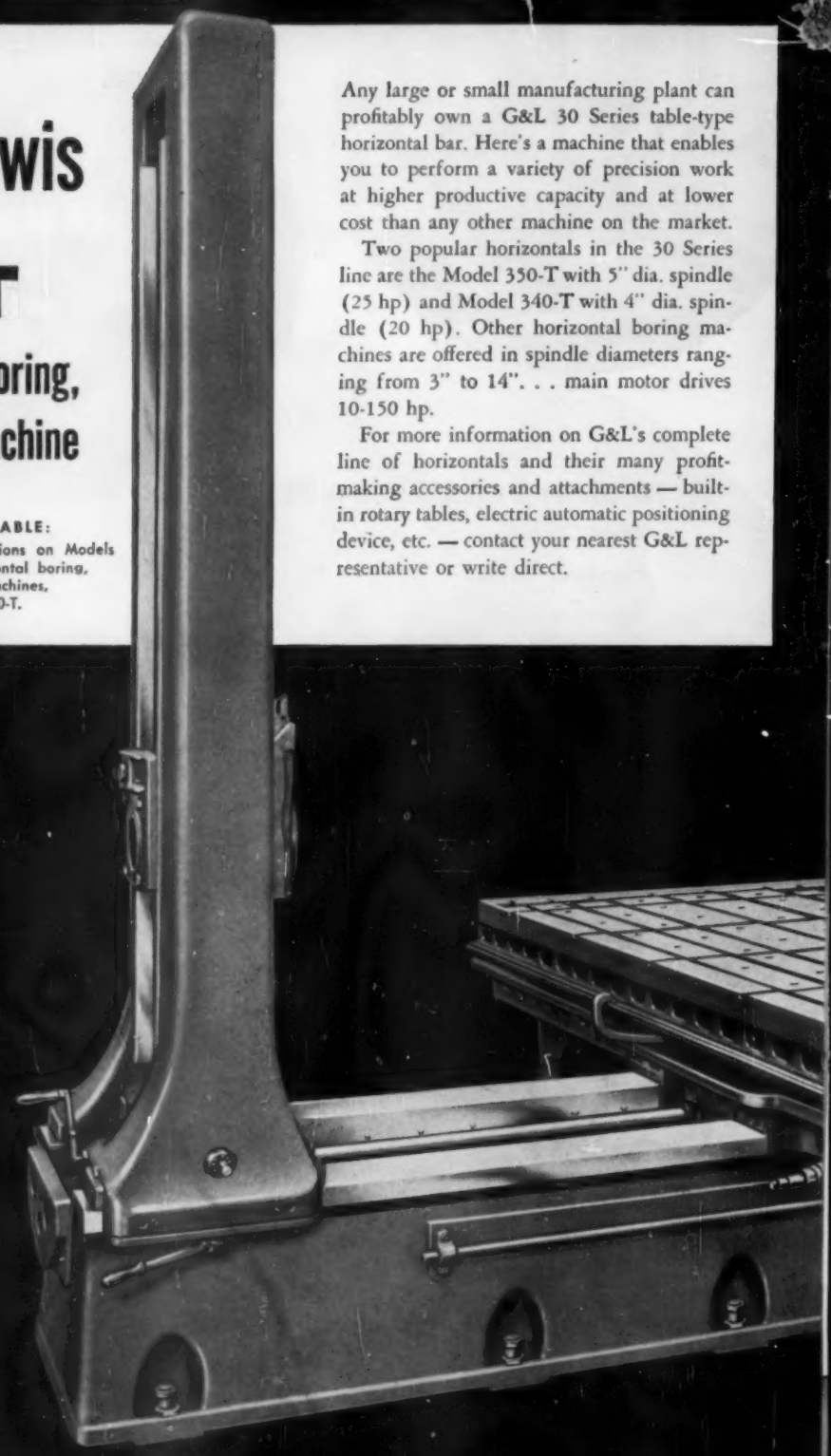
precision horizontal boring, drilling and milling machine

LITERATURE AVAILABLE:
For complete specifications on Models 350-T and 340-T horizontal boring, drilling and milling machines, write for Bulletin No. 30-T.

Any large or small manufacturing plant can profitably own a G&L 30 Series table-type horizontal bar. Here's a machine that enables you to perform a variety of precision work at higher productive capacity and at lower cost than any other machine on the market.

Two popular horizontals in the 30 Series line are the Model 350-T with 5" dia. spindle (25 hp) and Model 340-T with 4" dia. spindle (20 hp). Other horizontal boring machines are offered in spindle diameters ranging from 3" to 14". . . main motor drives 10-150 hp.

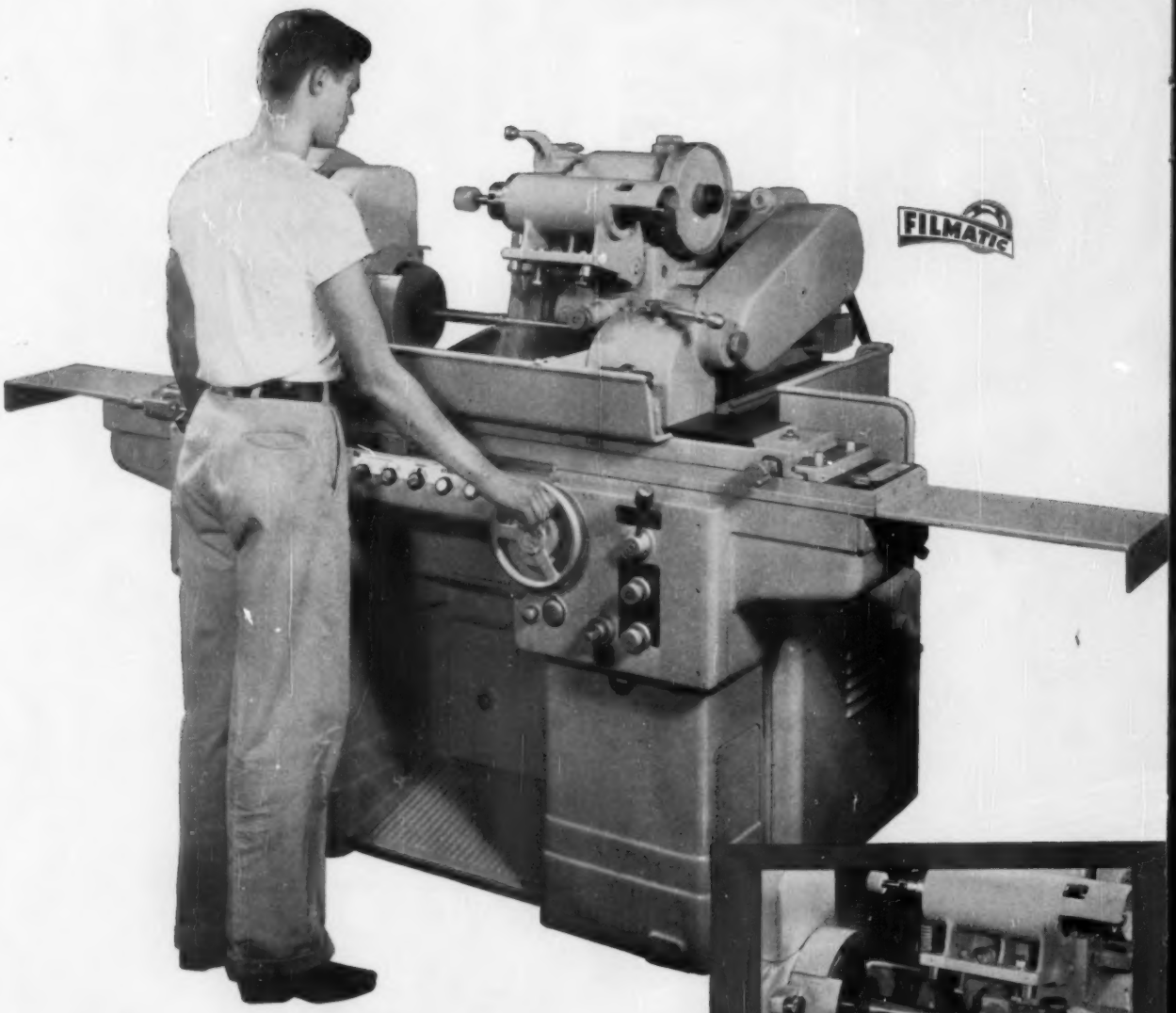
For more information on G&L's complete line of horizontals and their many profit-making accessories and attachments — built-in rotary tables, electric automatic positioning device, etc. — contact your nearest G&L representative or write direct.



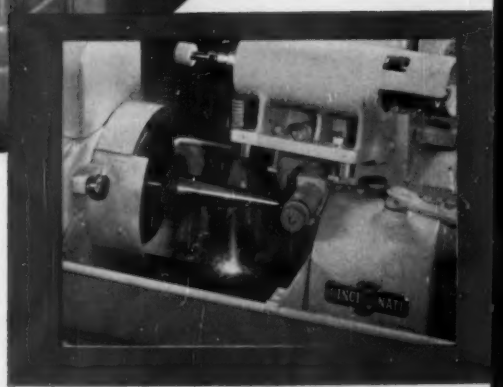
G & L *and* HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN G-69

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines, and VARIAX Milling Machines.

This CINCINNATI Precision



Grinding a slender shaft . . . one of many types of precision toolroom and production grinding operations performed on CINCINNATI FILMATIC 10" Universal Grinding Machines.



Traverse grinding a taper. Amount of taper ground on these machines can be as much as 4½" per foot.

CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE

UNIVERSAL

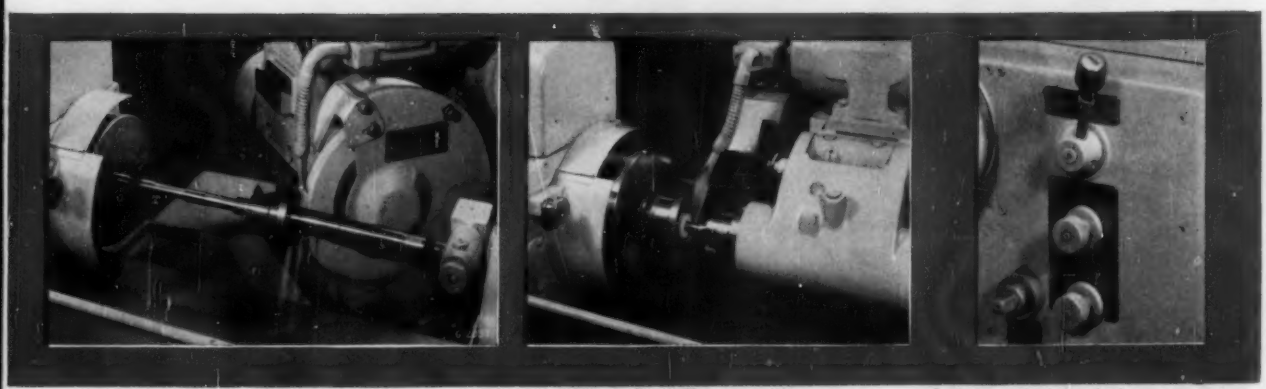
Grinds One Part or Hundreds

Look at your universal grinders from this viewpoint: when the need arises, can they handle big quantities at the low cost expected of high production equipment? It's routine work for the CINCINNATI® FILMATIC 10" Universal illustrated here. In addition to an unusual degree of versatility, this machine is equipped for automatic infeed grinding. For this type of work, a movement of one hand initiates the complete grinding cycle . . . rapid advance wheel to work, grind, tarry, return, and start and stop headstock rotation and coolant flow. ¶ The 10" Universal's extra measure of power is a big factor in both toolroom and production work. Consider these items compared to other machines in its class:

Largest grinding wheel: 12" diam. x 1½" face
Most powerful wheelhead motor: 2 hp
50% larger headstock motor
Exclusive FILMATIC grinding wheel spindle bearings

In addition to all these production advantages, the CINCINNATI FILMATIC is a true universal. Wheelhead swivels 180° and 220°, upper and lower, respectively; headstock swivels 180°; headstock speeds are infinitely variable 60 to 600 rpm. Want more information? Sweet's Machine Tool File contains brief specs. Complete data in catalog No. G-577-5.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO



Interchangeable drive and grinding wheel, for grinding the right-hand face of shoulders. An excellent finish is produced with this equipment.

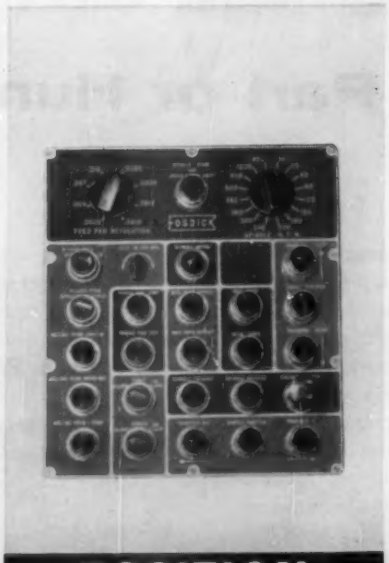
Internal grinding, one of the many operations performed at low, low cost on CINCINNATI FILMATIC 10" Universal Grinding Machines.

Automatic infeed elements. This type of equipment is built-in at the factory, does not restrict versatility of the machine in any way.

GRINDING MACHINES • CHUCKING GRINDERS • MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

MEASURE

Dial dimension direct from print. There are two sets of direct-reading drum dials, one for longitudinal, the other for transverse position. Operator simply sets dials so that numbers on dials correspond with numbers on blueprint. Simple. Direct. Precise.



POSITION

Press two buttons, one for longitudinal, one for transverse positioning. Table, and work, are automatically positioned, and clamped under the tool, accurate to ± .0001"! Accuracy is dependent upon highest-quality gages, not upon screw threads. Sensitive .0001 Dial Indicators maintain a positive check at all times.

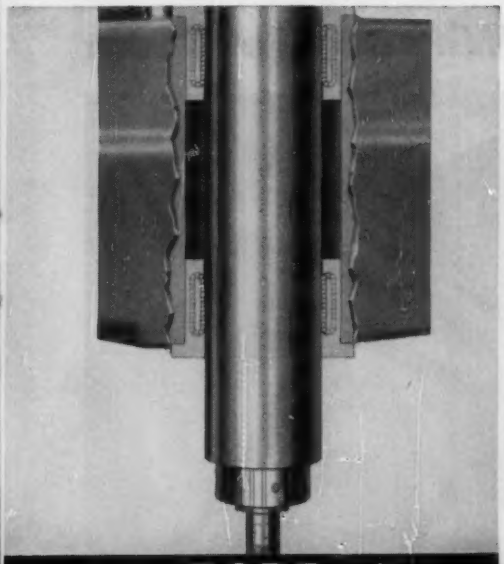
CHANGE TOOLS

Tool changing takes less than 10 seconds, with BF spindle. Can be accomplished while table is positioning. Hole sizes are repeated within ± .0001", without resetting tools! High-precision tool holder is built right into the spindle of the Jig Borer. Adapters accommodate both standard and special-sized tools.

FOSMATIC JIG BORER

AUTOMATIC POSITIONING

DIRECT DIMENSION MEASURING



BORE

Push-button precision boring. For finish boring, change tools quickly, then bore at touch of button. The hardened alloy steel quill rides on 800 preloaded balls mounted in precision bushings located permanently at top and bottom of head—as close as possible to spindle nose for maximum rigidity. Spindle is guaranteed not to exceed .0002″ runout at the end of 12″ proving bar!

MEASURE - POSITION - CHANGE TOOLS START BORING . . . ALL IN SECONDS!

hole size and position accurate to ± .0001.

The new Fosdick Jig Borer can be used for the finest toolroom boring or for production of precision holes. Like the scores of Fosdick Jig Borers in plants throughout the United States, this machine will perform consistently to ± .0001″ . . . in measured table and saddle position as well as hole size.

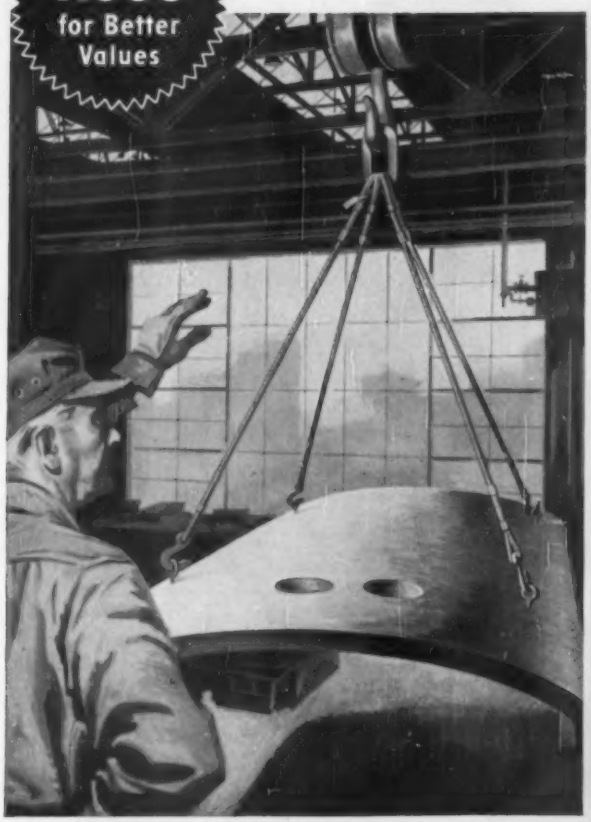
The Fosmatic Jig Borer is extremely simple to operate. Changing of feeds and speeds, all movements of the table, saddle, and head can be accomplished by push button. Spindle is started and stopped by lever on head. Machine may be equipped with or without automatic positioning. Can be equipped for numerical control with either tape or card systems.

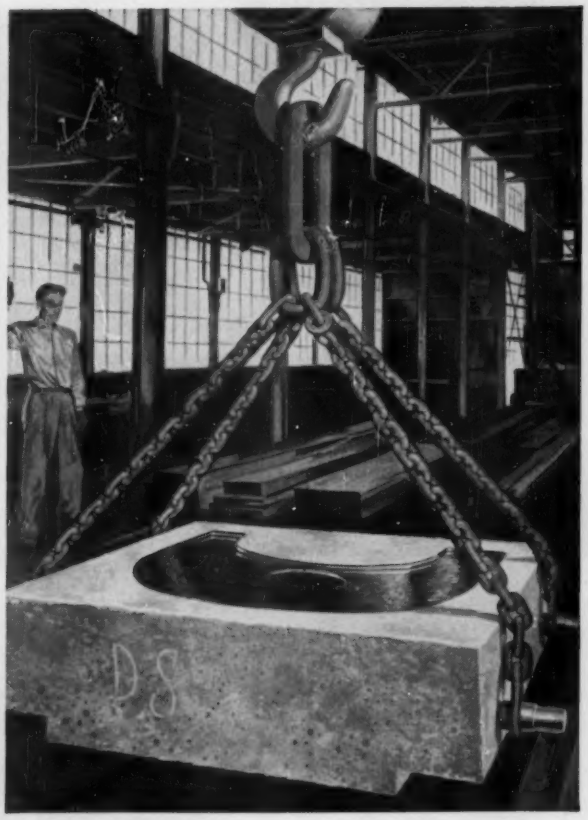
Other features available as extra equipment include Milling Feed, Rapid Traverse to Quill, coolant system and reversing motor for tapping.

Ask for Fosmatic Jig Borer Bulletin, JB-A.

ACCO for Better Values

Acco Registered® Slings—Wire Rope or Chain





Best Protection for Vital Lifting Operations...

• Safe slings are the best and most economical tools you can use for the vitally important job of lifting heavy assemblies, finished products or other costly loads. That's why more and more industrial users specify ACCO *Registered* Slings—Wire Rope or Chain, or a combination of both—as the finest possible protection against losses resulting from dropped loads.

The Safest Slings Made

No matter whether your lifting operations require chain slings, wire rope slings, or combinations, there is an ACCO *Registered* Sling for your purpose. And the ACCO *Registered* Sling possesses all the advantages of the ACCO *Registered* program—as detailed at the right. The additional safeguards of this program make ACCO *Registered* Slings truly "the safest slings made."

In addition, ACCO *Registered* Slings incorporate the latest technical improvements that increase sling safety and provide for greater lifting efficiency. Typical of these is a new shaped Master Link now provided without extra charge on all ACCO *Registered* Slings—both wire rope and chain. This new link, a development of ACCO's engineers, gives 18% greater resistance to distortion without increase in weight.

See Your Distributor

ACCO *Registered* Slings—wire rope, chain, or combination, are available from a distributor near you. Call him today. He offers you an extra bonus of safety and efficiency.

WHAT "ACCO REGISTERED" MEANS

1. The best material
2. Unit safety factor (on bodies, rings, links, hooks)
3. Proof test of complete sling to twice the working load limit
4. Actual field service test of each design
5. Metal identification ring or tag on each sling
6. Signed Registry Certificate with each sling

AMERICAN CHAIN & CABLE
BRIDGEPORT, CONN.

ACCO

Atlanta, Boston, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Wilkes-Barre, Pa., York, Pa.
In Canada: Dominion Chain Co., Ltd., Niagara Falls, Ont.

Exclusive features of Landis Universals shorten setup time . . . lower costs on grinding small parts

Landis 10″ x 20″ and 10″ x 24″ Universal Grinders: for toolroom or short runs where parts require high precision and fine finishes.

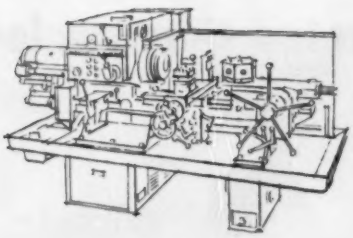
Exclusive eye-level *wheel feed* for easier operation, less chance for errors, quicker setup.

Exclusive swing-type internal grinding fixture with belt guard. Fixture does not interfere with operator when locked in raised position.

LANDIS

precision grinders

LANDIS TOOL COMPANY / WAYNESBORO, PENNA.



If you

were a turret lathe operator today,

wouldn't **you** *want*

to work at a machine

with this easy method

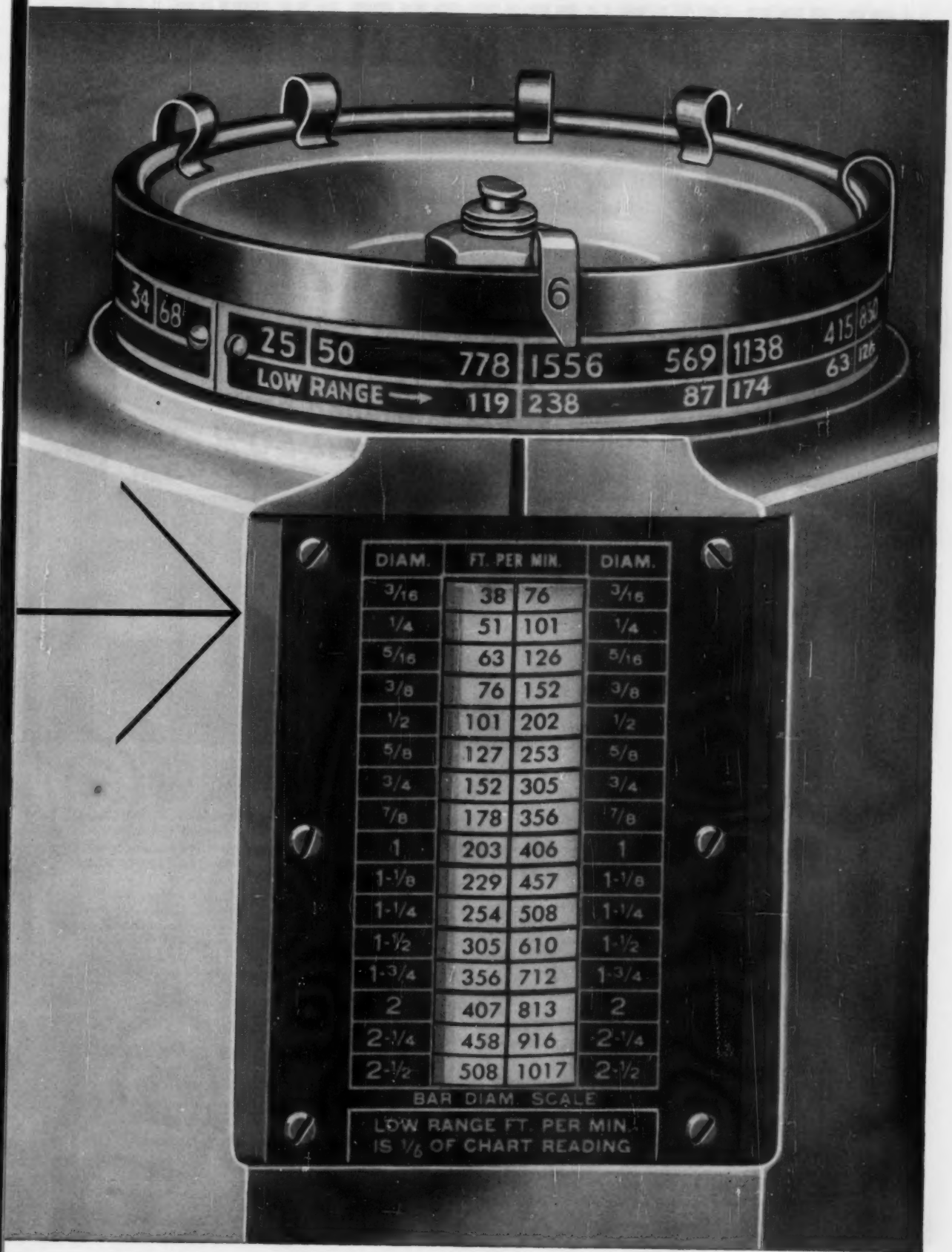
of preselection?

Only Warner & Swasey offers this direct-reading speed selector calibrated in work diameter, surface feet, and spindle rpm's—thus, no slide rules or conversion charts are required to determine proper spindle speeds. Movable number clips indicate at a glance your job's sequence of speed changes.

Ask your Warner & Swasey Field Engineer about this exclusive feature

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY


34
68
6
25
50
778
1556
569
1138
415
830
LOW RANGE →
119
238
87
174
63
126
DIAM.
FT. PER MIN.
DIAM.
3/16 38 76 3/16
1/4 51 101 1/4
5/16 63 126 5/16
3/8 76 152 3/8
1/2 101 202 1/2
5/8 127 253 5/8
3/4 152 305 3/4
7/8 178 356 7/8
1 203 406 1
1-1/8 229 457 1-1/8
1-1/4 254 508 1-1/4
1-1/2 305 610 1-1/2
1-3/4 356 712 1-3/4
2 407 813 2
2-1/4 458 916 2-1/4
2-1/2 508 1017 2-1/2
BAR DIAM. SCALE
LOW RANGE FT. PER MIN. IS 1/6 OF CHART READING

"GRADE MARKED" SHELBY TUBING

overnight delivery practically anywhere

By using
USS SHELBY SEAMLESS
MECHANICAL TUBING*
(instead of solid bar stock)
you can produce machined parts
like these at savings up to 50%

Results prove you get better jobs and save plenty by switching to

SHELBY SEAMLESS MECHANICAL TUBING

Precision-fit Guide Pin Bushing. The manufacturer of a wring-fit bushing switched to Shelby Seamless Tubing and produced a harder, stronger, more uniform, longer-lasting and better-fitting bushing.

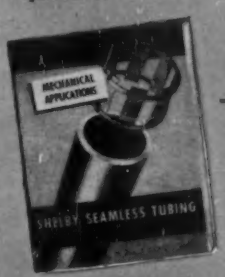
Used in 100 vital parts. The famous manufacturer of a crawler-tractor makes over 100 parts from Shelby Seamless Tubing to improve the performance and strength of his heavy-duty machine.

Made top roller for half-tracks with Shelby Seamless . . . reduced rejects 100% . . . saved 38% in steel . . . cut cost 39.1%. Excellent machinability of Shelby Tubing was just the answer to this mass production operation.

Stainless Steel Shelby Seamless solved wave guide tube problems for manufacturer of Radar Antenna Systems. Eliminated production and plating difficulties previously encountered with carbon steel. Solved corrosion problem . . . met weight and strength factors.

These are just a few of thousands of applications. If you'd like to know how and where you can use this time-and-money-saving seamless tubular steel to improve the parts you make, an inquiry will bring full information.

USS Shelby Seamless tubing is made by master craftsmen by the seamless process. Billets of the finest quality steel are first pierced, then precision-rolled to close tolerances inside and out. Thorough inspections and tests, all along the line, assure you tubing that's as near perfect as it is possible to produce.



This Free Book

tells how you can cut production costs and produce better parts. Write for your copy today.

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NOW AVAILABLE AT U.S. STEEL SUPPLY

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You can make better-quality parts faster and with less cost...
you save the wear and tear on tools...you save needless waste of steel.

It costs money to bore a hole through solid stock. It takes time. It wears out tools. It wastes steel. By using Shelby Seamless Mechanical Tubing you can eliminate or greatly reduce many time-and-labor-consuming operations connected with boring and machining.

Another important advantage in using Shelby Seamless Tubing is that its excellent machining characteristics and uniformity speed up production and improve the quality of your output. *You can turn out parts by the millions, and the last part will be as metallurgically and dimensionally accurate as the first.*

We stock USS Shelby Seamless Tubing in a complete range of sizes, in different wall thicknesses, various finishes and steel analyses, in all of our 18 warehouses. Your order will be shipped to you in neatly strapped bundles, and each bundle will carry U. S. STEEL SUPPLY'S *exclusive* "GRADE MARK" seal which clearly shows the grade in that particular bundle. Thus, without altering your stocking procedure in any way, you have positive identification of each grade. This new GRADE MARK SERVICE speeds handling, too, and is another reason why it pays to buy from U. S. STEEL SUPPLY.

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UNITED STATES STEEL

Using fast broaching speed and broaching two parts at once it is now possible to LAPOINTE the port faces on all surfaces of this

This remarkable production rate of less than 20 seconds each (at 80% efficiency) is achieved by a broaching speed of 120 feet-per-minute, allowing the operator an ample thirteen seconds to handle each part.

Carbide tooling . . . chatterless broaching. Carbide tipped tool bits and solid carbide blades remove approximately 5/32" stock on each surface (and that adds up to a lot of cubic inches!) Carbide tooling is entirely practical at the rapid broaching speeds for which Lapointe-built machines, equipped with electro-mechanical drive, are designed. In the production of automotive parts, where a saving of pennies on any operation builds up to a staggering annual figure, it is essential to make each moment count!

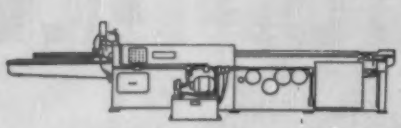
Lapointe has eased the burdens of production executives in the automotive industry for a great many years — not only by substantially stepping up production but also by taking full responsibility for the entire broaching program, including the building of the broaching machines, the fixtures and the broaches. Why not ask a Lapointe Field Engineer to discuss modern broaching with you?

THE LAPOINTE MACHINE TOOL COMPANY

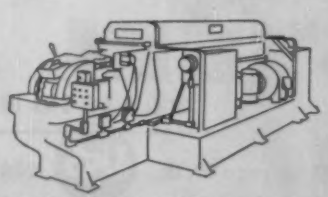
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

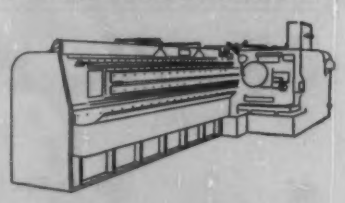
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE



60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC

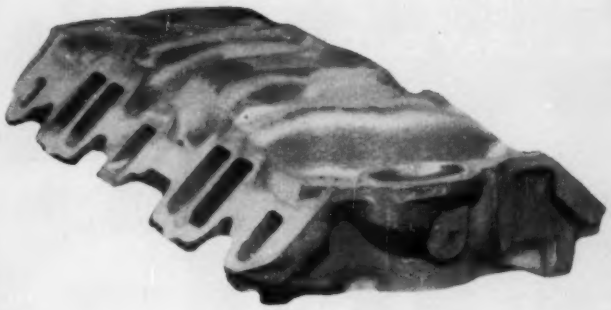


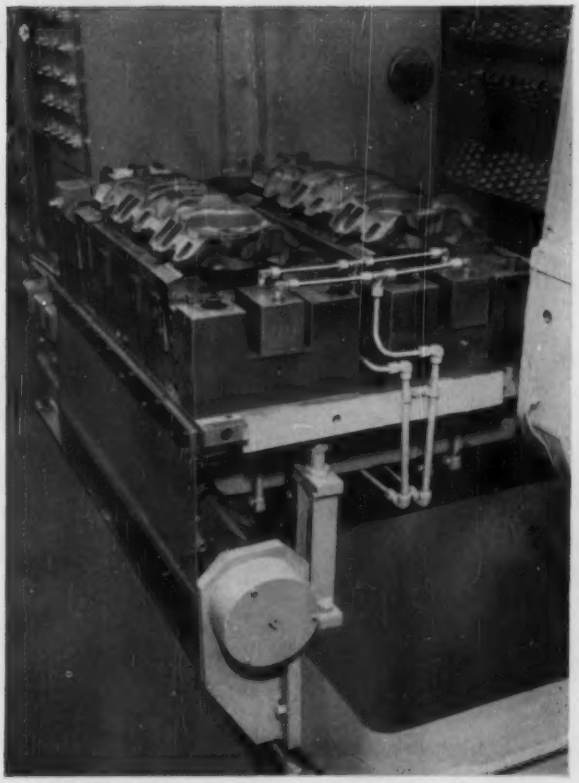
SRHE SINGLE RAM HORIZONTAL, ELECTRIC

—BROACH

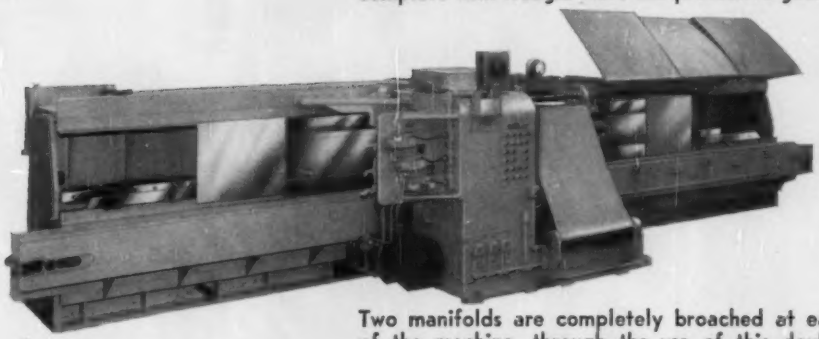
INLET MANIFOLD

at 206 parts per hour!

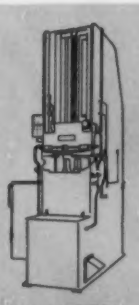




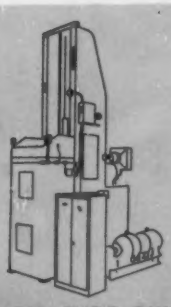
LAPOINTE SRHE, 150-inch stroke Single Ram Horizontal Broaching Machine with Electro-mechanical Drive. Equipped with positive action oscillating chip conveyor complete with trough. Note the protective guards.



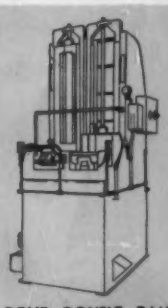
Two manifolds are completely broached at each cycle of the machine, through the use of this double work-holding unit (hydraulically operated), together with a wide 24-inch slide on which two sets of broaches are mounted.



VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC



DRVE DOUBLE RAM VERTICAL, ELECTRIC

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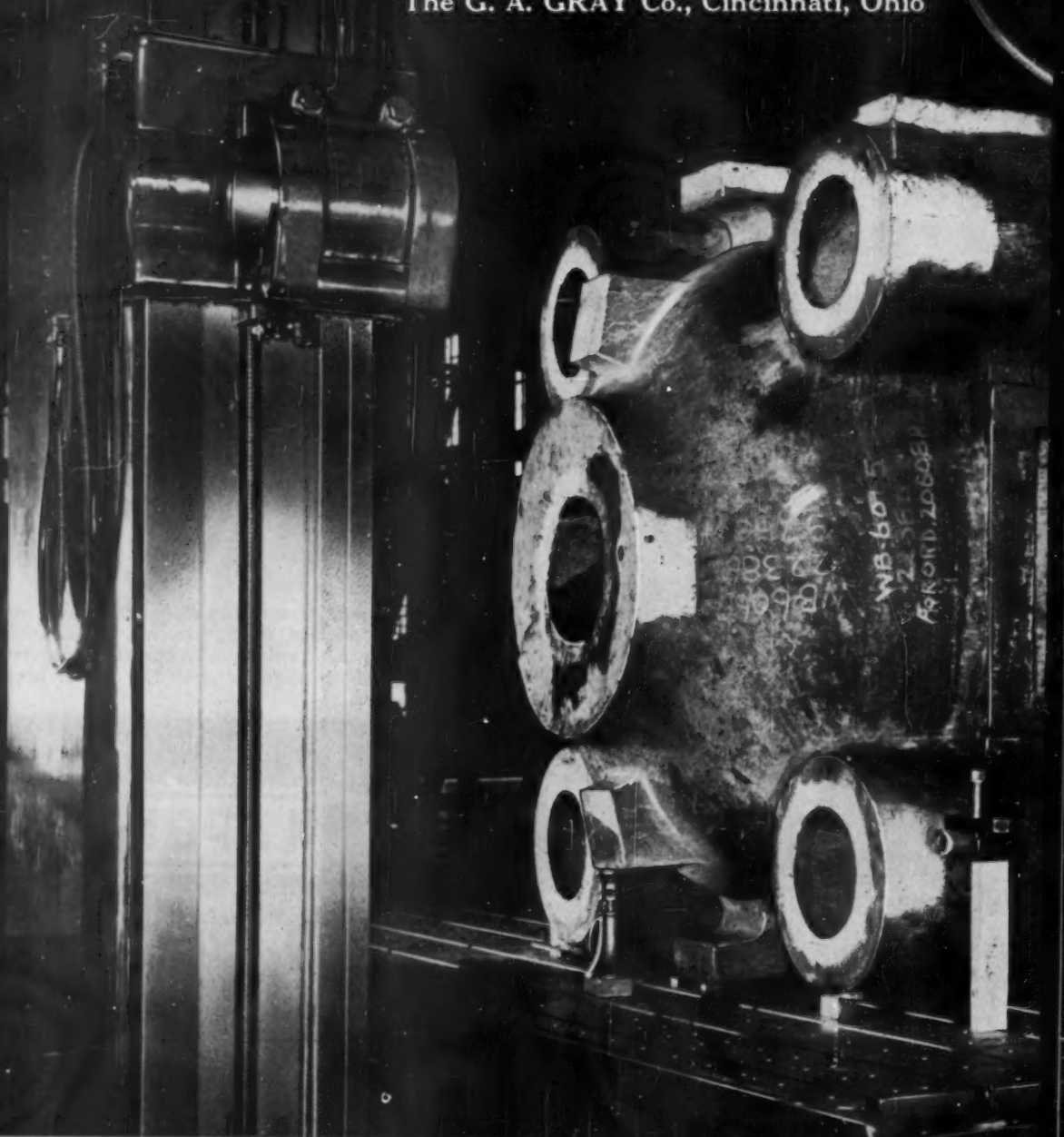
known to be the best in

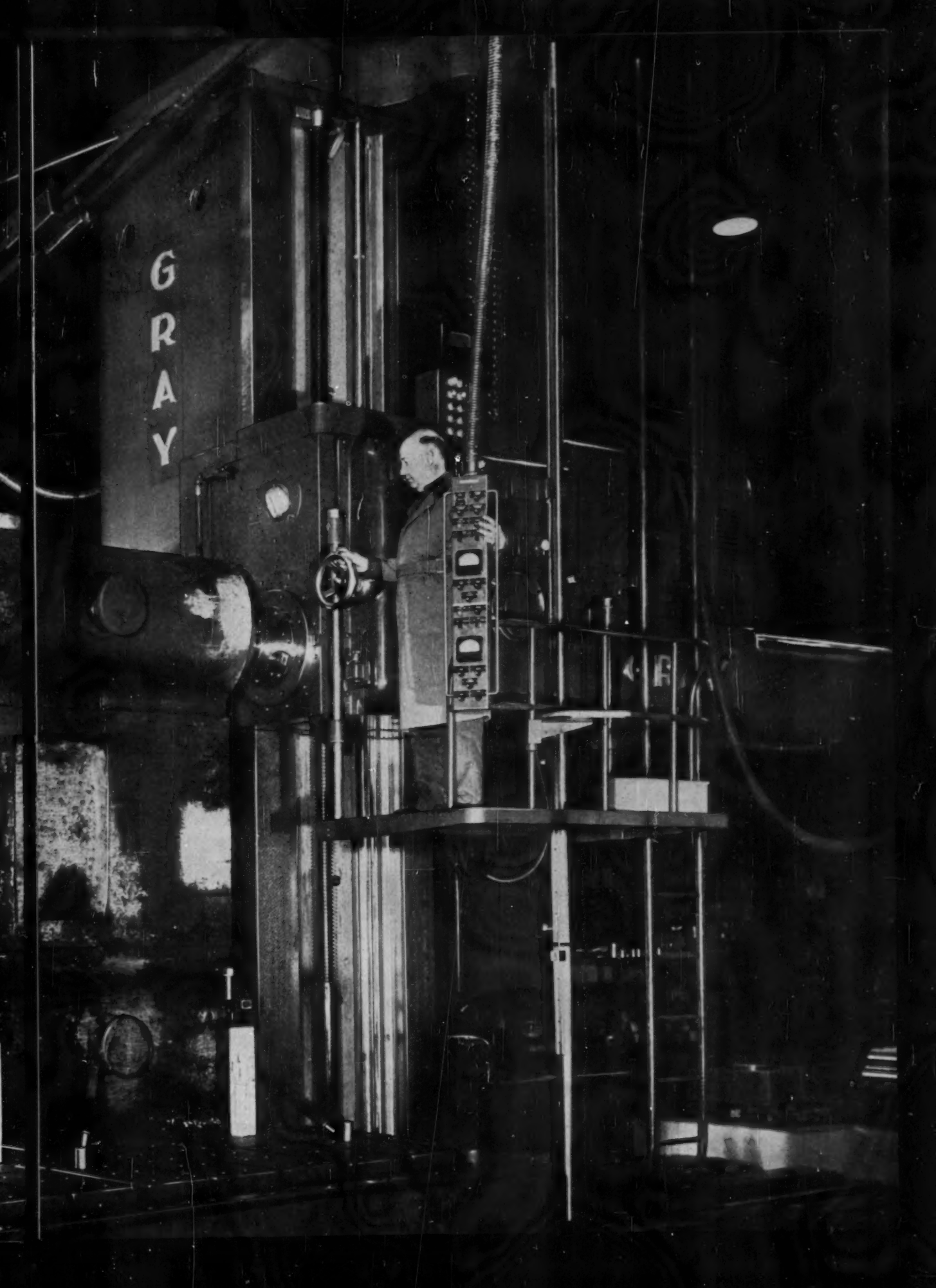
BROACHING

brute POWER

. . . flows from this Gray giant at the touch of a button.
Its massive design and tremendous rigidity guarantee heaviest
carbide milling. Magically, precision boring to minute
tolerances is equally available on this 8″ Gray Horizontal.
Its amazing convenience permits small machine speeds
for the first time in the elephant field.
That's why . . . large jobs don't grow old on a Gray.

The G. A. GRAY Co., Cincinnati, Ohio




GRAY

New Snyder Special Transfer Replaces Automation in Processing Forged Steel

Special Features of Snyder Machine No. 55-44

1. Production: 146 pieces per hour.
2. 26 Stations: 28 Operations per piece: 2 milling, 1 sawing, 4 hollow milling, 3 reaming, 1 countersinking, 10 drilling, 5 spotfacing, 1 threading and 1 tapping.
3. Palletized fixtures each carrying two parts.
4. Parts quickly and accurately clamped and located and unclamped by combination torque wrenches and hydraulically operated mechanisms at Stations 1 and 26.
5. Ten individual base segments provide maximum flexibility for future part design changes.
6. Ample room between segments for tool changes and maintenance.
7. Motorized fixture return conveyor with fixture washing unit.
8. Ample chip and coolant facilities.

Standard Features of Snyder Machines

1. SNYDER SELF-CONTAINED UNITS and other units equipped with hardened and ground ways.
2. Threading and tap heads equipped with individual leadscrew spindles.
3. Minimum downtime for tool changes because spindles are arranged for pre-set cutting tools.
4. Standard and special parts interchangeable for speed and economy in maintenance.
5. Motorized automatic lubrication system for all moving parts.
6. Construction to J.I.C. Standards throughout.
7. Master Push Button Panel and Light Console at Station 1.
8. Each unit equipped with its own push button control station for ease of tool setup and manual operation of unit.
9. Electrical interlocks and full depth circuit throughout.
10. Panels equipped with SNYDER CIRCUIT SLEUTH.

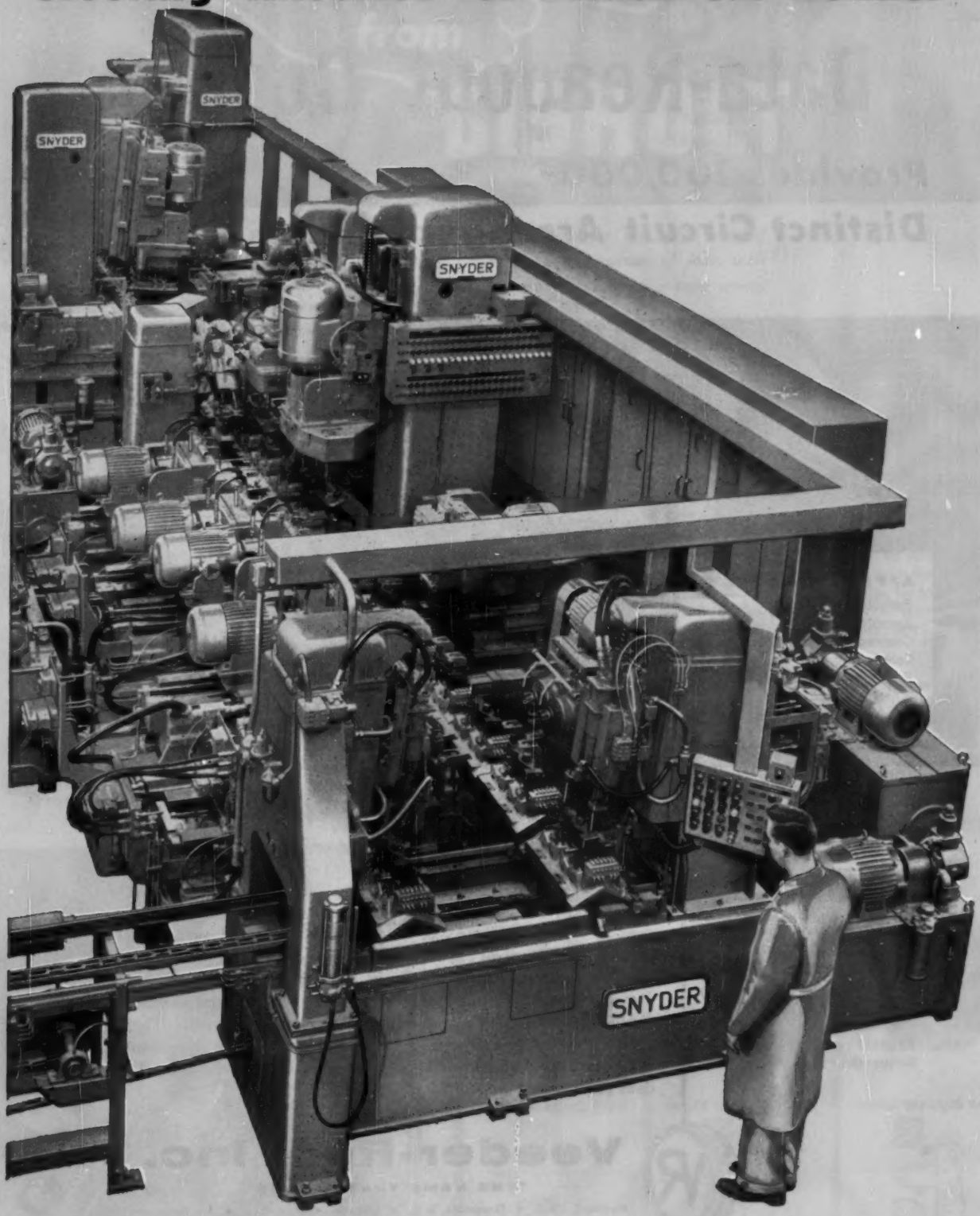
SNYDER

TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

32 Years of Special Machine Tools with Automation

Several Semi-Standard Machines with Steering Knuckles for British Car Builder



NEW

Data-Readout Counter

Provides 100,000 Distinct Circuit Arrangements

Electrically actuated data readout counter with electric reset. Form B-1538 for 110V AC/DC.

FUNCTIONS

Analog to Digital Conversion
Serial or Parallel Circuit Transmission
Continuous or On Demand Electrical Readout
Continuous Visual Readout
Visual and Electrical Data Storage
Predetermining
Repeat Predetermining
Sequential Programming

Veeder-Root's new series of Data Readout Counters combines visual indication with electrical readout for remote indication, recording, and controlling applications. *Electrically* or *mechanically* driven and provided with *manual* or *electric* reset, these counters present a positive display of accumulated totals and automatically create specific control circuit contact closures for each number visually displayed. Each instrument, with its five figure capacity, provides 100,000 distinct circuit arrangements which lend themselves to the most exacting control and transmission requirements. The counters are compatible with standard data processing equipment and offer a wide variety of applications in the industrial control and data processing fields.

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Production Pointers from GISHOLT

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help cut time and costs in your own work.

ELECTRIC CYCLE SELECTOR CUTS CHANGE-OVER FOR MARLIN-ROCKWELL CORP.

Three different cycle patterns available for machining bearing races

This smart setup on the Gisholt MASTERLINE No. 12 Automatic Production Lathe may give you some cost-cutting ideas. Marlin-Rockwell Corp., Jamestown, N.Y., is using it to machine 9 different sizes of steel inner and outer bearing race forgings in record time.

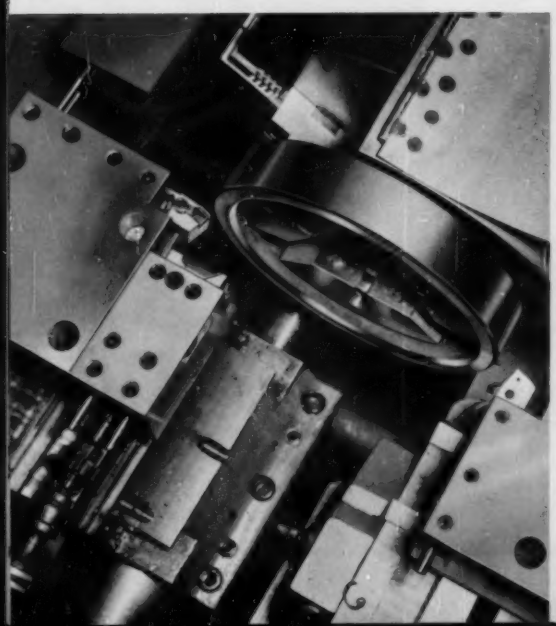
All workpiece sizes are handled within 3 basic cycle patterns (shown in diagrams) for the front carriage. In setting up for each part, the operator simply selects the correct cycle from a 3-position switch on the starter box at the rear of the machine.

Cycle No. 1 is for outer bearing races. A typical setup is shown below. Work is chucked in the I.D. Front carriage tools traverse, feed longitudinally to turn and form the O.D. chamfer, and cross-feed to chamfer the I.D., while a tool on the rear independent slide faces the part. Both the carriage and slide reverse-traverse to starting position, completing the cycle. Floor-to-floor time for all sizes: only 1.7 minutes.

Cycle No. 2 is for inner bearing races. Work is chucked on the O.D. Front carriage tools bore and form the I.D. and cross-feed to relieve the boring tool, while the part is faced from the rear slide. Both reverse-traverse to starting position to end the cycle. Three part sizes are handled in 1.6 min. f.t.f. One smaller size is completed in 1.0 min., including facing and forming the O.D. edge from the rear independent slide.

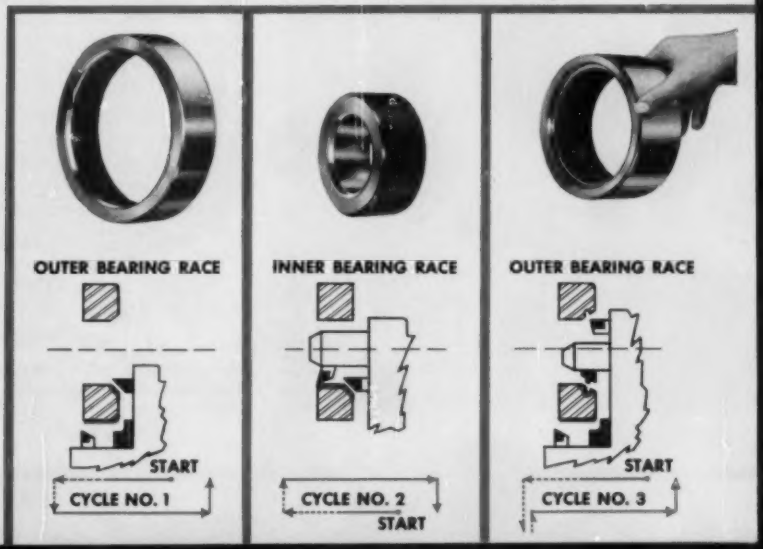
Cycle No. 3 is used on one type of outer bearing race. Chucked in the I.D., front carriage tools turn and form the O.D. chamfer, rough cobore the I.D., cross-feed to form a snap ring groove and reverse-feed to clear the form tool. Again, facing is from the rear slide. Reverse-traverse to starting position completes the cycle. F.t.f. time: 1.5 min.

Simple selector switch cuts downtime by making 3 basic operating cycles instantly available. Different chuck jaws are required for inner and outer races. Jaw inserts handle diameter changes. Minor tool and stop adjustments permit completion of change-over in record time.



Tooling for cycle No. 1. Note swivel-jaw which minimizes distortion and centralizes part.

Three different part types handled are shown after first machining operations.



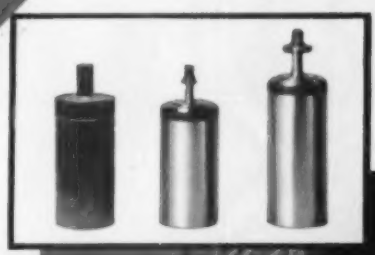
MASTERLINE GISHOLT SINCE 1887

CUT MACHINING TIME WITH

TIME-SAVING IDEAS

HOW MACHLETT LAB. MACHINES TRI-METALLIC PARTS

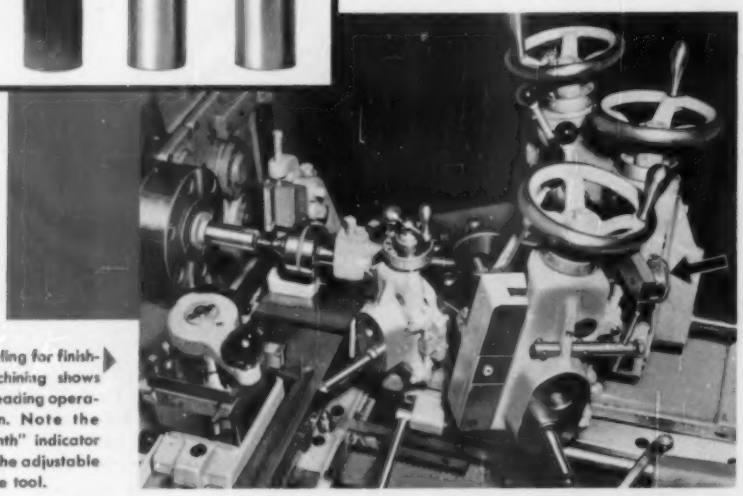
Speeds operations, assures accuracy with "tenth" indicators on adjustable slide tools



Two different workpieces handled. Largest is 4¾" long; smallest is 3½". Both are 1½" in diameter.

This well-planned operation rates close study.

Machining DX anode assemblies, Machlett Laboratories, Springdale, Conn., is getting close tolerances and fine finishes with the new Gisholt No. 3 MASTERLINE Ram Type Turret Lathe—handling easily distorted copper tubing in the body, a steel insert shoulder and head, and a threaded end of molybdenum.



Tooling for finish-machining shows threading operation. Note the "tenth" indicator on the adjustable slide tool.

Three operations complete each workpiece. For the first, the part is chucked in the I.D. on an air-operated expanding mandrel and the O.D. is rough-machined. A live center supports at the end while tools on the square turret and rear tool post face and form.

Turned end-for-end for the second operation, the part is held in an air-operated collet chuck on the previously machined O.D. Hex turret tools rough- and finish-bore the copper body and co-bore the steel insert at the far end. For finish boring, "tenth" indicators are mounted on the adjustable slide tools to hold tolerances of .0005" in the co-bore and .001" in the body.

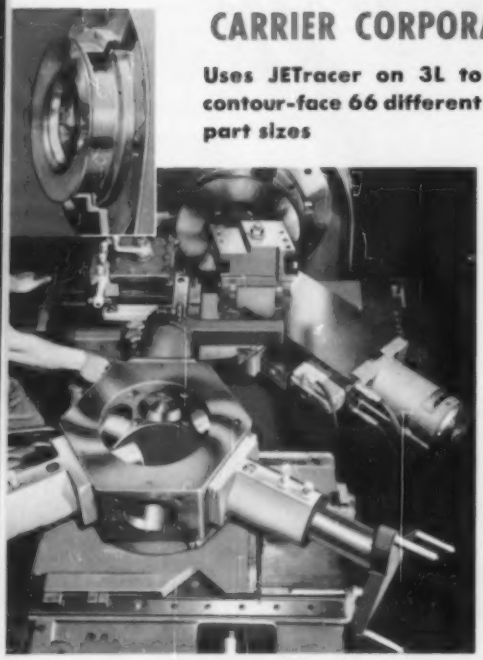
For the third operation (shown in illustration), the piece is again chucked in the bore on the mandrel and all O.D. surfaces are finish-machined, threading the molybdenum insert end from the hexagon turret with a self-opening die head and turret-threading attachment.

Tooling remains intact for all 3 operations. Concentricity is held within .001" between I.D. and O.D. over length of part. F.t.f. times: 3.10 min. for first operation; 4.65 for second; 3.10 for third.

A Preventive Maintenance Chart is now available for both Ram Type Turret Lathes and Saddle Type Turret Lathes. Write Gisholt for copy.

CARRIER CORPORATION CUTS TOTAL TIME 50% ON IMPELLER WHEELS

Uses JETracer on 3L to contour-face 66 different part sizes



You, too, may be able to use a setup like this one at Carrier Corporation, Machine & Systems Division, Syracuse, N. Y. Here, the modern JETracer—on the bridge type cross slide on a standard 3L Saddle Type Turret Lathe—improves machining of 37 different sizes of steel impeller hubs, 29 different sizes of mating covers, and repair parts for impeller wheels used in the manufacturer's well-known centrifugal compressors.

Eight separate operations, 4 in each face, are used for the 21"-diam. part shown at left. Alternating machining between faces cleans up any stress distortions and assures concentricity and parallelism between the contoured surfaces.

The part is gripped on the O.D. by a special fixture (mounted on a 24", air-operated 3-jaw chuck) to machine one side, and held in the bore by an air-operated expanding mandrel to machine the other side. Before each chucking, a turret-mounted pusher forces the work on a support ring against a vibration dampener.

Tooling used to finish-machine impeller cover. Note turret-mounted template carrier in center. Inset shows finished part on special fixture mounted on chuck.

Straight boring is handled from the hex turret, which also carries a special turret-mounted template carrier to govern movement of the JETracer. Tools on the cross-slide square turret turn, rough-face and chamfer—and the JETracer rough- and finish-machines the contoured face. A variable-speed motor drive assures constant surface cutting speed to meet surface finish requirements.

Total floor-to-floor time for all 8 operations is only 46.25 minutes, replacing several different machines formerly used. Total machining time was cut 67%. Tolerances are held to ± .001" on the bore and ± .005" on thickness.

GISHOLT

LOOK AHEAD... KEEP AHEAD... WITH GISHOLT

GISHOLT

TIME-SAVING IDEAS

HOW WALWORTH SIMPLIFIES CLOSE-TOLERANCE TAPER BORING

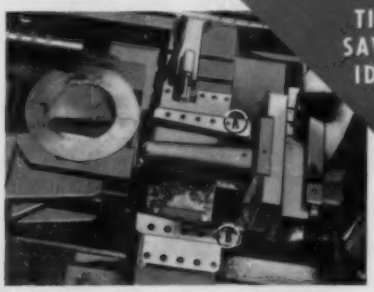
Special cams on front and rear cross slides guide taper-boring slide tool

You may see ways to cut costs in your own operations by checking this set-up. With it, the Walworth Company, Inc., Kewanee Works, Kewanee, Ill., gets accuracy and fine finish on 11 different sizes of cast iron and cast steel plug valve bodies. The machine used is the Gisholt Fastermatic Automatic Turret Lathe.

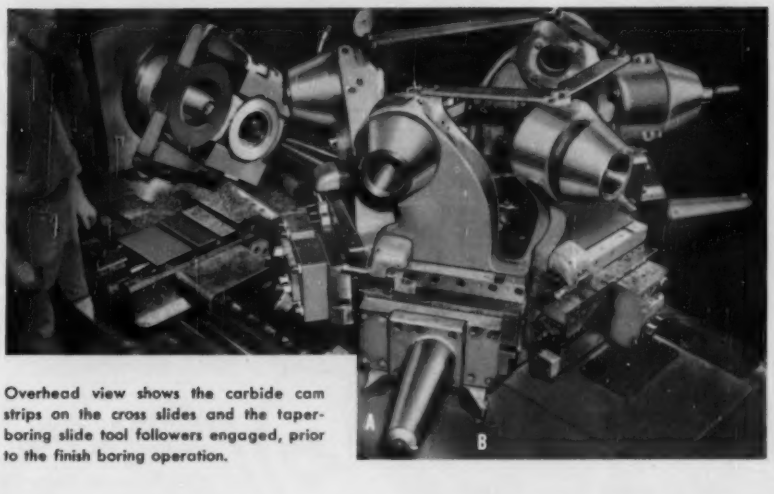
Workpieces are held in a hand-operated 2-jaw chuck. A turret-mounted carrier bar simplifies loading, moving the rough workpiece into the chucking fixture and locating it accurately for length before chucking. Rough- and finish-taper boring, counter-boring, grooving, facing and sizing operations are handled by hexagon turret tools.

An unusual camming arrangement assures accurate machining and fine finishing of the taper bore and counter-bore. Here's how it works: Carbide-tipped followers (A and B), on both sides of the taper-boring slide tool, move between special plates, with solid carbide cam strips, mounted on the front and rear cross slides. Air-operated follow-up from the rear cross slide forces the taper-boring slide tool to follow the cam on the stationary front cross slide, generating the required taper in the plug valve bore. Results: extreme taper accuracy and uniform fine finish, so essential for long service life.

Eleven different parts are handled, with f.t.f. times ranging from 9.4 min. on smallest 2" plug valve body, to 22.8 min. on largest 6" body shown in illustration. Special taper cam eliminates human error, provides finer finish.



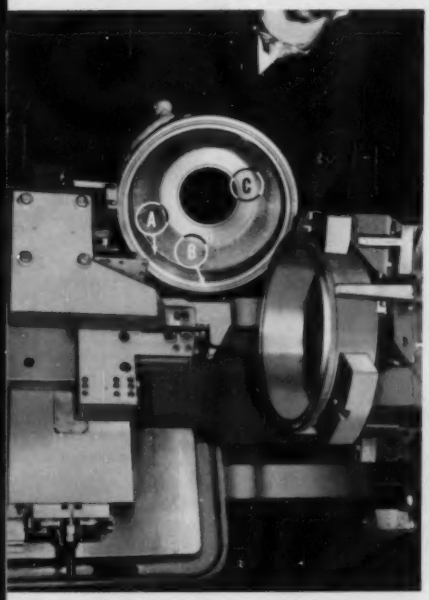
Fixture, workpiece and tooling for 6" flanged plug valve body. Note carbide-tipped cam followers A and B on taper-boring slide tool.



Overhead view shows the carbide cam strips on the cross slides and the taper-boring slide tool followers engaged, prior to the finish boring operation.

MACHINES BRAKE DRUMS FRONT AND BACK IN SINGLE CHUCKING

Well-planned setup handles 13 surfaces, including straddle-facing and boring



Overhead view shows platen table back for loading and unloading. Note straddle-facing and boring tool arrangement.

In looking over this tooling setup on the Gisholt Simplimatic, you may spot ideas on low-cost machining of parts like these cast iron brake drums. Four different sizes are handled, with minimum tooling change-over and adjustment between sizes.

Here's how the 19"-diam. drum is machined, holding work in a 24", 3-jaw air chuck. Using extended jaws plus operating the Simplimatic table 12" back of standard position gives the straddle-facing tools ample clearance. Wide swivel jaws centralize the part and minimize distortion. A positive stop locates the work from the back side of the rim.

The front slide mounts a cam-operated auxiliary slide which engages the 2 tools that bore the large I.D. (A), reducing machining time by dividing the cut. Other tools on this slide chamfer the I.D. edge and turn the rim (B). A special tool block holder on top of the front slide carries additional tooling to rough- and finish-bore the web (C). As the platen table moves into operating position, tools on the rear independent slide protrude through the bore. Standard slide movement lets the tools straddle-face, chamfer and co-bore the web (C), and at the same time finish-face and form the rim (B) to complete the part.

The Simplimatic—ideal for jobs like this—holds f.t.f. time on this part to 4.2 min. Wide platen table permits positioning of slides and tooling to machine more surfaces in less time. Automatic cycle frees operator for additional machines or other work.

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

HERE'S HOW TRANE COMPANY BALANCES 45 DIFFERENT BLOWER FANS

Smart tooling assures accuracy by minimizing parasitic weight

If your production setup includes balancing of rotating parts, you'll want to read how The Trane Company of La Crosse, Wis., uses the Gisholt 1S DYNETRIC Balancer on a wide variety of similar parts—with minimum change-over.

Here, the 1S handles 45 different types of single- and double-width blower fan wheels used in air conditioning, ventilating and special industrial process systems. Although weights and sizes of the fans fall within the 1S range, in some instances the weight of a standard arbor used for support equals or exceeds the weight of the part.

Here's how the effects of this parasitic weight are minimized: Fan wheels are divided into two groups, one with bore diameters less than 1" and the other 1" or larger. In each group, the widest fan determines the length of arbor used for that entire group. The arbors have small bearing diameters and a larger center diameter with a shoulder and key. A keyed bushing is pressed onto the arbor. Parasitic weight is minimized by slots milled through the bushing, leaving 6 lands ⅜" wide to support, locate and drive in the hub of the fan wheel to be balanced.

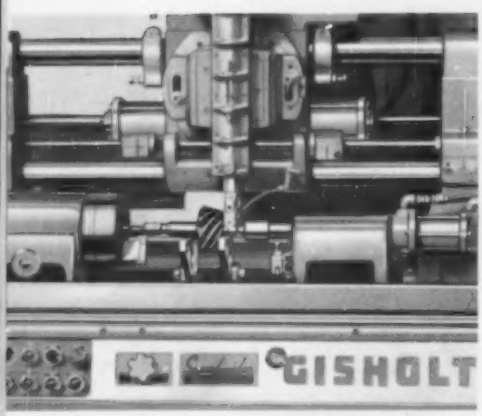
Unbalance is located and measured in 2 planes, and corrected by adding solder on the outer shroud rings. The fan is rotated again to inspect for balance, completing the operation.

Operator rotates workpiece to check for any unbalance remaining after correcting with solder, in 2 planes, at each end of the part.

A large variety of similar parts is handled with minimum change-over through well-planned tooling. The 1S handles all production, assuring quiet, vibration-free operation of high-speed, lightweight parts.

THIS SETUP SUPERFINISHES 120 PINION GEARS AN HOUR

Eliminates operator fatigue with loading rails, air-operated tailstock



Workpiece shown held between centers ready for Superfinishing operation. Note loading rail, faceplate driver and air-operated tailstock.

Want convincing evidence of what Superfinishing can do to lower costs and improve quality?

This manufacturer is completing bearing surfaces, on 8 different sizes of steel rear drive pinion gears, at a rate of 120 parts per hour at 80% efficiency—using a Gisholt 51A Superfinisher. Here is peak production—attained by using a standard machine with a simple set of loading rails, plus an air-operated tailstock to pick up the workpiece prior to the Superfinishing operation.

Here's how it works: The operator moves each part to the loading rail, where it rolls by gravity and stops automatically in line with the tailstock center. A faceplate driver catches the splines on the workpiece, and movement of the tailstock center lifts the part from the loading rail to clear the work during the automatic Superfinishing cycle. The surface finish is reduced from 20 to 30 down to 5 to 7 micro-inches R.M.S. or less, in just 25 seconds f.t.f. time.

Eight different workpiece sizes are Superfinished with minimum change-over. Superfinishing provides extremely smooth surface finish in less time, and exposes true base metal for long surface life which promotes trouble-free operation.

No. 5-657
681

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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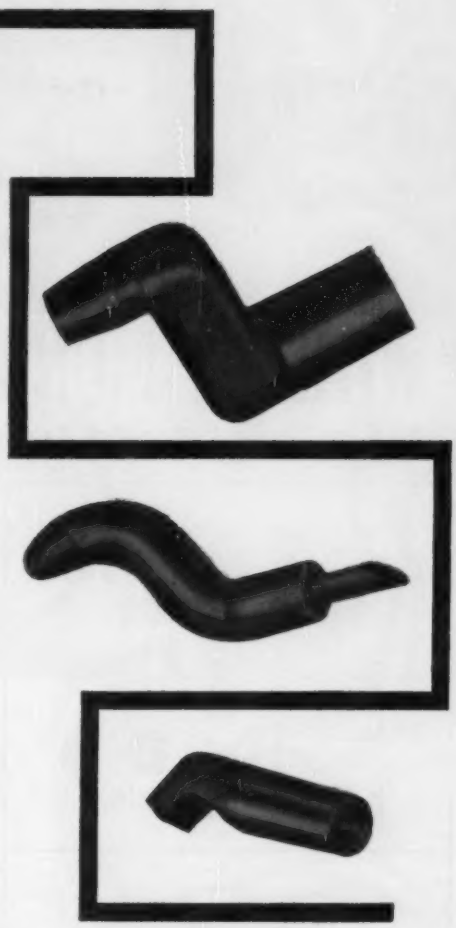
GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Solve Your *Special* Resistance Welding Problems with Mallory *Standard* Electrodes



BEFORE you pay the extra price of special electrodes, both in added cost and longer delivery, it pays to check the many types available as standard from Mallory.

In the Mallory standard list are literally hundreds of designs . . . all available promptly, manufactured by existing tooling. Many are carried by Mallory distributors for immediate delivery. Included are cold formed single and double bend types—cast and forged off-set designs—a wide choice of nose shapes, tapers and lengths—and models with Mallory's special fluted cooling hole, for efficient cooling right up to the electrode face. All are made from the specialized alloys and by the precision manufacturing methods that Mallory has developed during more than thirty years of resistance welding leadership.

Your local Mallory Welding Distributor can lend valuable help in working out ways to use this broad line of electrodes to solve "special" problems at "standard" prices. And he can give you prompt delivery, usually from his local stock, of exactly the electrodes you need. Write to us today for the name of the Mallory Welding Distributor nearest to you.

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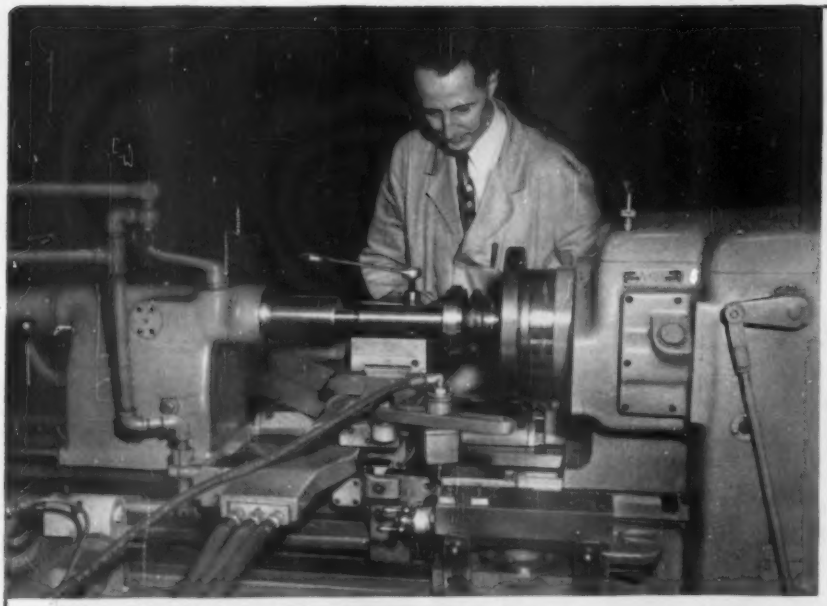
For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio

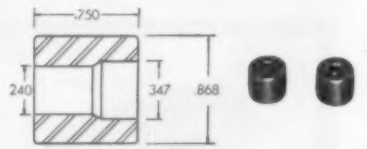


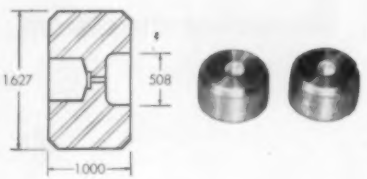
Finish turning operation on a hi-speed steel heading die, using a Monarch 13″ Series 61 Air-Gage Tracer Lathe, .015″ stock is removed within a limit of ±.0005″. Turning time is 15 minutes compared to 2 hours previously required on a conventional engine lathe.

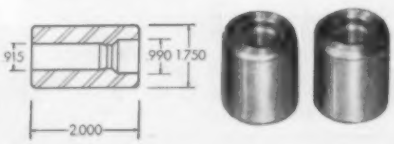
WITHOUT MONARCH–TIME'S A-WASTING!

Air-Gage Tracer Lathes Cut Contouring Time from 2 Hours to 15 Minutes — ± .0005″!

Group of typical heading dies which are finish bored on the 10″ Model EE Air-Gage Tracer machines. Drawings show complexity of work. Under the same conditions as above, the same time savings are realized.







Can you ignore savings like these reported by Standard Pressed Steel Company?

They use a battery of Monarch Air-Gage Tracer lathes in their production toolroom for finishing operations on small forging dies. Most of the work is contour boring to exceptionally close limits plus quite a variety of contour turning.

The machines go sixteen hours per day, six days per week. Monarchs were chosen because of Standard Pressed Steel's previous satisfaction with this make of lathe. The Monarch flame hardened, precision ground bed ways are considered a must in this plant. These tracer controlled lathes are much faster and more accurate than the conventional engine lathes previously used and more uniform in performance.

Now, check over the job reports in the picture captions. Two hours cut to fifteen minutes! You're right —you can't ignore savings like these! Write now for our Booklet # 2608... **The Monarch Machine Tool Company, Sidney, Ohio.**

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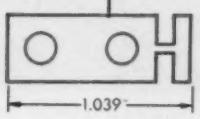
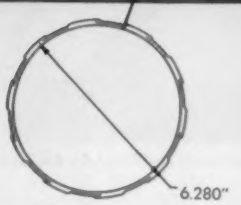
ACCURACY • ECONOMY • LONG LIFE
TURNING MACHINES

FOR A BETTER TURN FASTER ... TURN TO MONARCH

Gardner dual fixturing adds versatility





Production:
2100 parts per hour
Stock Removal:
.020" over-all, rough cut
.010" over-all, finish cut

Tolerances

Flatness:	.0003"
Parallelism:	.0003"
Uniformity:	.001"
Finish:	11 RMS

Production:
1 part every 40 seconds
Stock Removal:
.011" to .016"

Tolerances

Flatness:	.001"
Parallelism:	.0003" to .0004"
Uniformity:	.0008"
Finish:	11 RMS

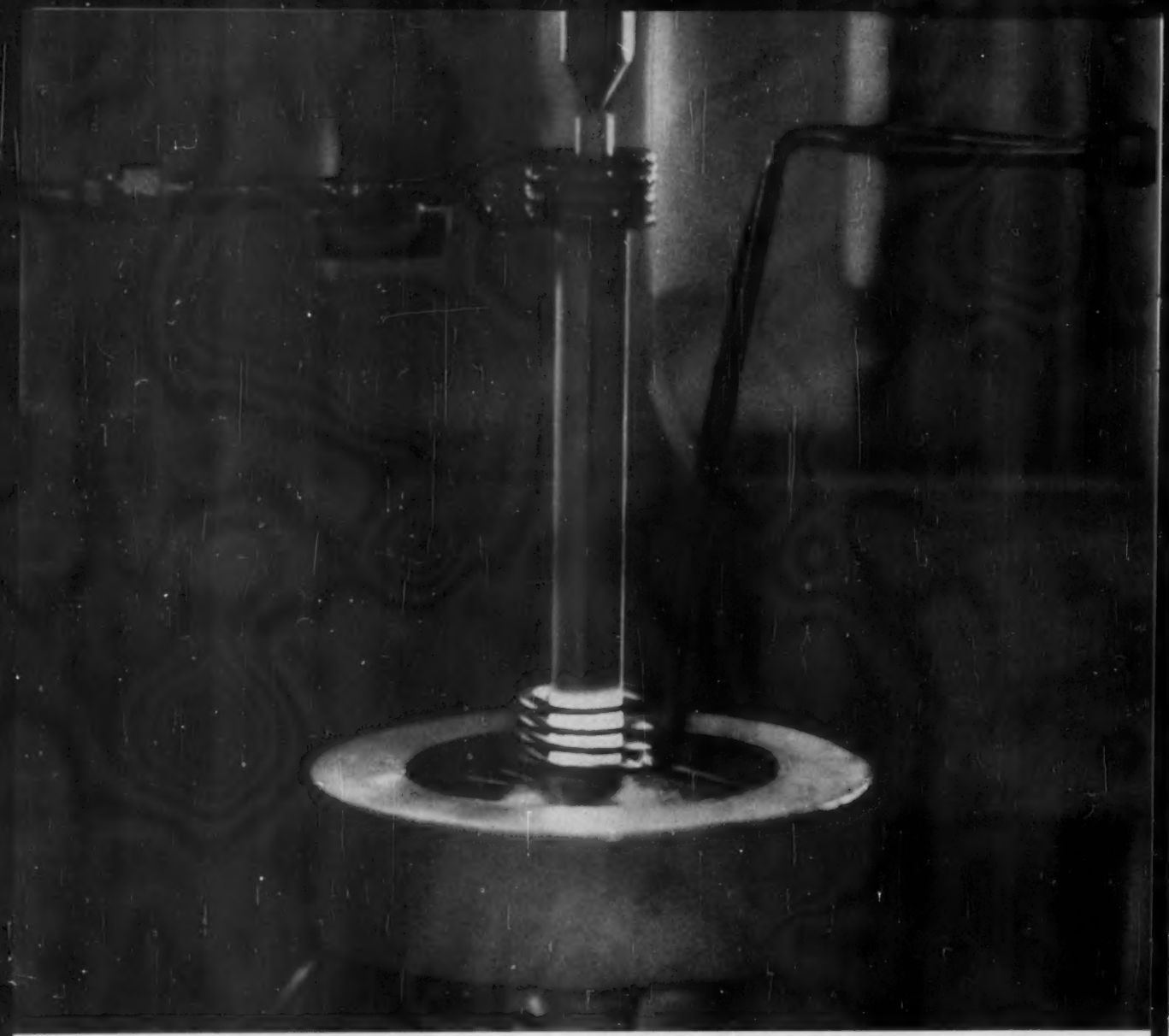
Gardner Double Disc Grinder 115-20" with drawings of work carriers and workpieces.

grinds TWO parallel surfaces in ONE operation

GARDNER

precision disc grinders

BELOIT, WISCONSIN



Ketos shaft being induction hardened to Rockwell 55-56, while ends remain soft for final machining. Photographed at Control Instrument Co., Inc., Brooklyn, N. Y.

KETOS has wide hardening range with minimum volume change...

Ketos is a low priced alloy tool steel that can be hardened from low temperatures with practically no volume change. It has deep hardening qualities, and a fine grained structure, that make it desirable for many production parts.

That's why nondeforming Ketos is well suited not only for most tool steel applications such as gauges, dies, and taps but also for close-tolerance, wear-resistant parts like the actuator bar shown in the induction heating unit above. The thin contact edges of this particular part withstood a "life test" of over 4-million high speed blows. No other steel tested lasted more than 1-million cycles before it chipped and failed.

If Ketos sounds like the steel you should be using, call your nearby Crucible warehouse. Stocks of Ketos and dozens of other special tool steels are large, delivery fast. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

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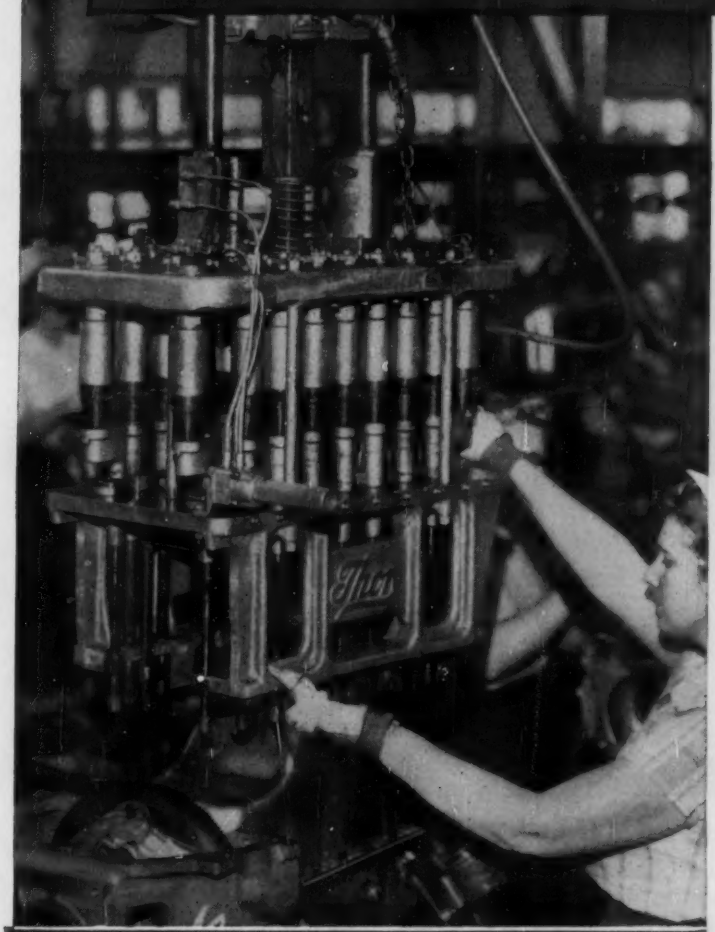
If you run two or more fasteners at the same time—cut costs with

THOR MULTIPLE NUTSETTERS AND SCREWDRIVERS



Now, thanks to Thor multiple nutsetters and screwdrivers, the largest to the smallest assembly operation can enjoy the cost cutting benefits of automation. If you have production assembly jobs involving 2 to 20 or more nuts or screws, Thor multiples can return their cost in labor savings, in improved quality control, time and time again.

Running multiple fasteners at one time means every fastener is tightened to identical torque simultaneously with no shift in tensile load equilibrium which occurs when fasteners are tightened one at a time.

For the complete story of how Thor multiples can help you, write today for Thor's free book "Automation in Assembly." Thor Power Tool Company, Prudential Plaza, Chicago 1, Illinois.

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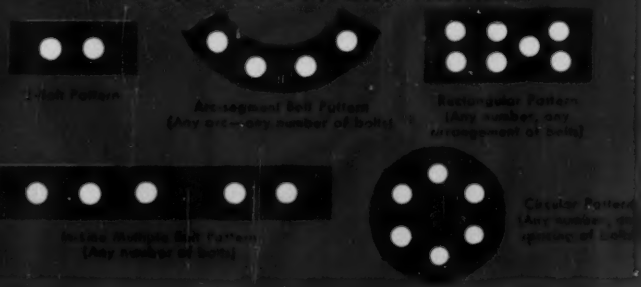
TOOLS

Thor multiple tools can be custom-built to any pattern, any number



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AUTOMATION MANUAL ON MULTIPLE FASTENER SETTINGS

Pictures, diagrams, all the facts

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production equipment produces MORE with PEECO

STOKES

NOW developed PEECO feeders are included on STOKES pharmaceutical equipment. The Model 538 Mark II (illustrated) produces press coated tablets with a high degree of uniformity and precision at rates up to 750 per minute. Tablet cores are fully activated, without dusting within the PEECO feeder bowl.

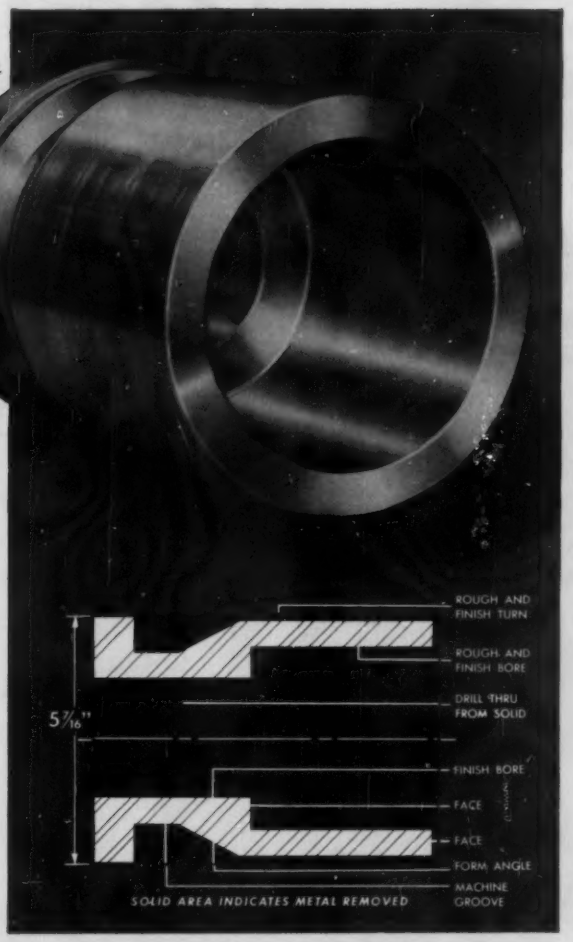
PEECO'S leadership in the field of vibratory parts feeders has contributed much in helping increase the capacities of new production equipment in various markets. We are glad to include among the companies now being served by PEECO, F. J. Stokes Corporation of Philadelphia, Pennsylvania, manufacturers of pharmaceutical equipment for two-thirds of a century.

If you want to produce more, send for bulletin No. 365 and ask for the name of the PEECO representative in your area.

THE WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF VIBRATORY PARTS FEEDERS

Peeco PERRY EQUIPMENT & ENGINEERING CO.

ERIE, PA. — A DIVISION OF AUTOMATION DEVICES, INC.



Let me show you how one of our P & J Automatics

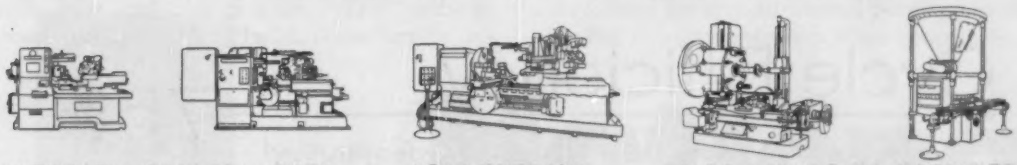
Hogged Out Over

31 POUNDS OF STEEL IN 6¾ MINUTES!

This job looked really tough. Machining from the solid meant unusually heavy metal removal . . . and our customer had to hold some pretty close tolerances and turn out parts *fast*! Here's what did the trick! Our new P&J Automatics have the extra power it takes to hog out metal fast *and* the extra rigidity that's needed to stay within the required limits under the heaviest feeds. You can see how teaming a machine like this with P&J Tooling, to save even more time by combining cuts, made it possible to complete one of these spools every 11 minutes. A new P&J Automatic can bring performance like this into your plant too. Send me your sample prints, and I'll show you how a P&J Automatic with P&J Tooling can help you turn out your toughest jobs faster, better and at lower cost. Write to Potter & Johnston Company, Pawtucket, Rhode Island.

HERE ARE THE FACTS:

PART: *Chuck Operating Spool.*
MATERIAL: *Cut-Off Bar Stock #34 Carbon Steel.*
REQUIRED: *Machine from the solid. Ten separate precision cuts.*
RESULTS: *A part completed every 11 minutes in a single, fully automatic cycle, removing a total of 40 pounds of metal.*
MACHINE: *P & J Model 6DRE-40.*



AUTOMATIC TURRET LATHES . . . GEAR CUTTERS . . . GILDA PACKAGING MACHINES

POTTER & JOHNSTON
SUBSIDIARY OF PRATT & WHITNEY COMPANY, INC.
PRECISION PRODUCTION TOOLING SINCE 1898

no wonder this shop is "100%"

Machine Utilization

98%

The result of *extreme machine rigidity* which maintains precise tool settings throughout the run . . . keeps down-time to an absolute minimum (in this case an average of only 16 minutes per machine per shift).

Cycle Efficiency

75%

Made possible by Acme-Gridley *Controlled Cycle* operation, which assures a steady, predetermined production pace.

Acme-Gridley"

"We call 'em workhorses" says Mr. Bob Barnd, Factory Manager of Eaton Screw Products Plant, Tube & Hose Fittings Division of the Parker Appliance Co., describing the Acme-Gridley Bar Automatics and Chuckers in this 100% Acme-Gridley equipped Eaton Ohio plant.

Carefully kept records certainly prove these Acme-Gridleys can take it. They are operated two 8-hour shifts a day, five days a week—with a utilization factor of 98%, combined with a cycle efficiency of 75%. In a period of one month, they produce well over two million hydraulic tube and hose fittings. "The machines themselves," says Mr. Barnd, "are largely responsible for our low down-time. Once setup, they are rigid enough to maintain the most precise setting, shift after shift."

* * * *

This is typical of Acme-Gridley performance all over the world. It is the end result of two important Acme-Gridley basic design features: (1) *controlled cycle time*, which maintains a steady, hour-after-hour, predetermined production pace; and (2) *extreme machine rigidity*, that comes from being built with an ample reserve of beef, properly distributed, for an extra margin of assurance today—and for any additional burden tomorrow's tooling requirements may place upon them.

why don't you
INDEX... to lower machining costs...
with Acme-Gridley
CONTROLLED CYCLE

National Acme

THE NATIONAL ACME CO.
171 EAST 131ST STREET
CLEVELAND 8, OHIO
Sales Offices... Newark, N. J.... Detroit, Mich.... Chicago, Ill.

You get

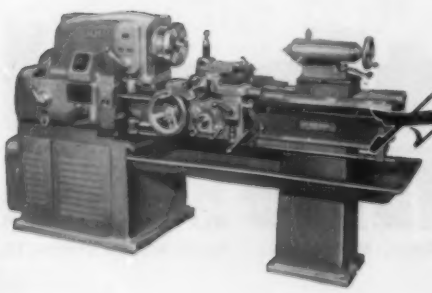
top value per dollar

with a Hendey No. 2E Lathe

timesaving controls step up efficiency of toolroom or production turning!

Because all controls were designed with the operator in mind, the Hendey No. 2-E general-purpose lathe today is setting new standards of efficiency on both toolroom and production jobs. Two outstanding features are the electronic drive that permits infinitely variable speed control, and the instantaneous dynamic brake for rapid stopping and reversing of the spindle.

Here are more Hendey "top-value" features you'll want to check further: quick-change gearbox providing 48 changes of threads without changing gears; thread-chasing dial for returning carriage to the same thread groove; quick-change gearbox for 48 changes of feed without gear change; pushbutton energizing of main motor; and *two* control levers, permitting operator to start, stop, or reverse the spindle from any working position. Contact your nearby Hendey dealer for complete details and specifications.



for precision with production, buy Hendey

Hendey machine division

BARBER-COLMAN COMPANY

51 Loomis St., Rockford, Illinois

BARBER COLMAN ®

Synchronous Speed with Induction Simplicity

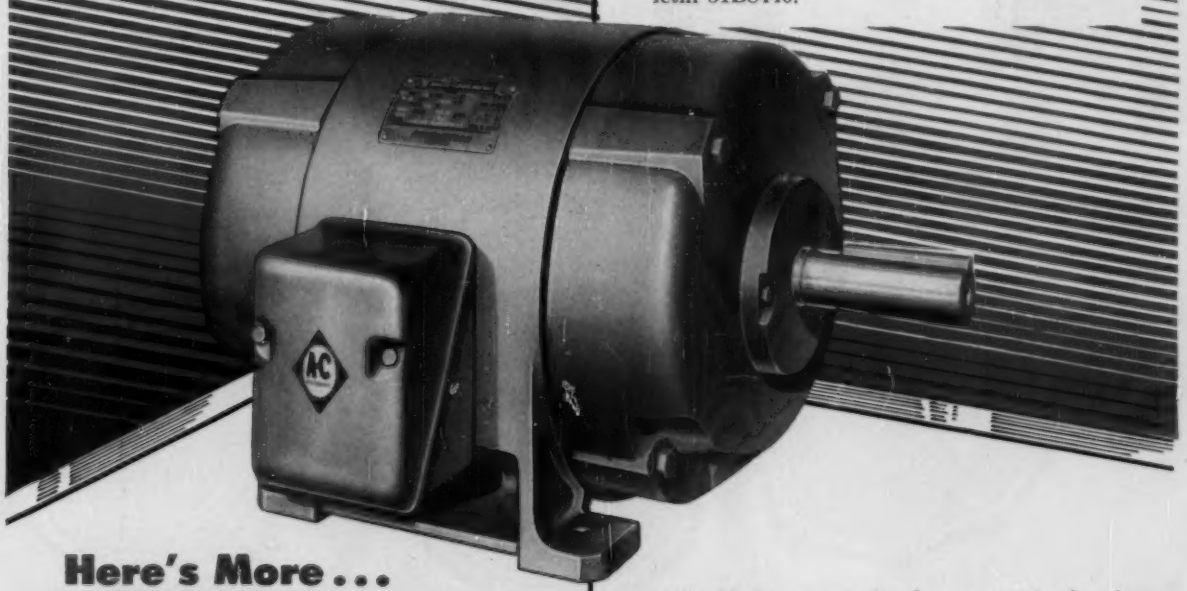
New *Synduction* Motor

...has uses in:

- Synthetic Fiber Production
- Wire Drawing
- Plate-Glass Conveyors
- Packaging Machinery
- Food Processing
- High Speed Cameras
- Metering Pumps
- Electronic Computers
- Printing Presses
- Frequency Converter Sets
- Drives for Electronic Power Supplies
- Continuous Bristle Cutting

Do YOU Have an Application?

Allis-Chalmers engineers are anxious to help you determine where *Synduction* motors can improve your operations. Call your A-C office or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin, for Bulletin 51B8440.



Here's More...

- **Constant speed, regardless of load or voltage, depends only on frequency**
- **Synchronized speeds for a number of motors**
- **Adjustable speed by frequency control at any speed setting**

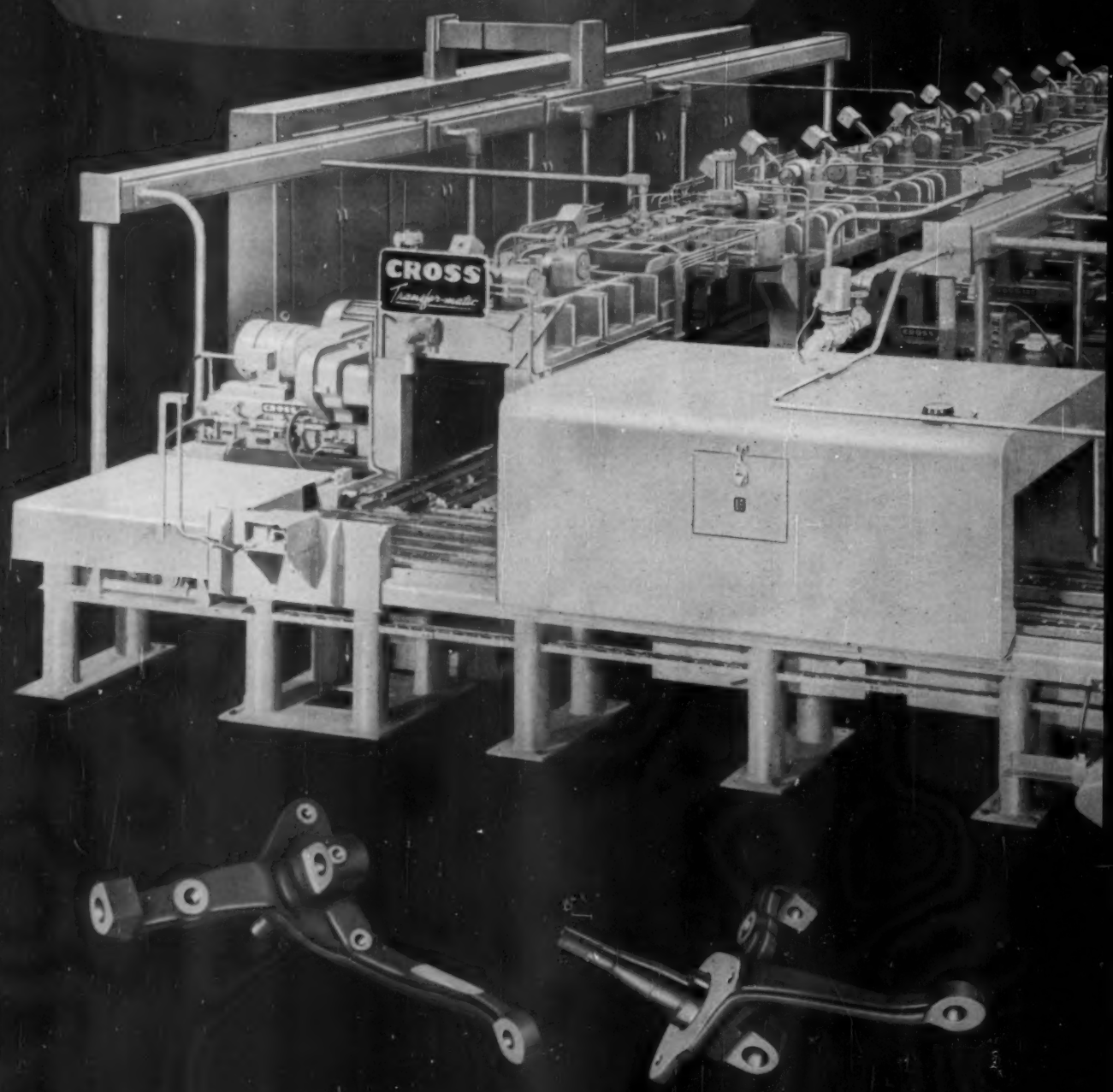
Allis-Chalmers new development—the *Synduction* motor — now makes these characteristics available at low cost. The sturdy frame and simple design, similar to that of a squirrel-cage motor, eliminates collector rings, brushes and rotor insulation — cuts maintenance. Other important advantages include across-the-line starting, wide range of speeds and high efficiency.

Synduction is an Allis-Chalmers trademark.

ALLIS-CHALMERS

A-5118

Mills, Drills, Reams, Threads Integral Front Wheel Spindle and Steering Arm



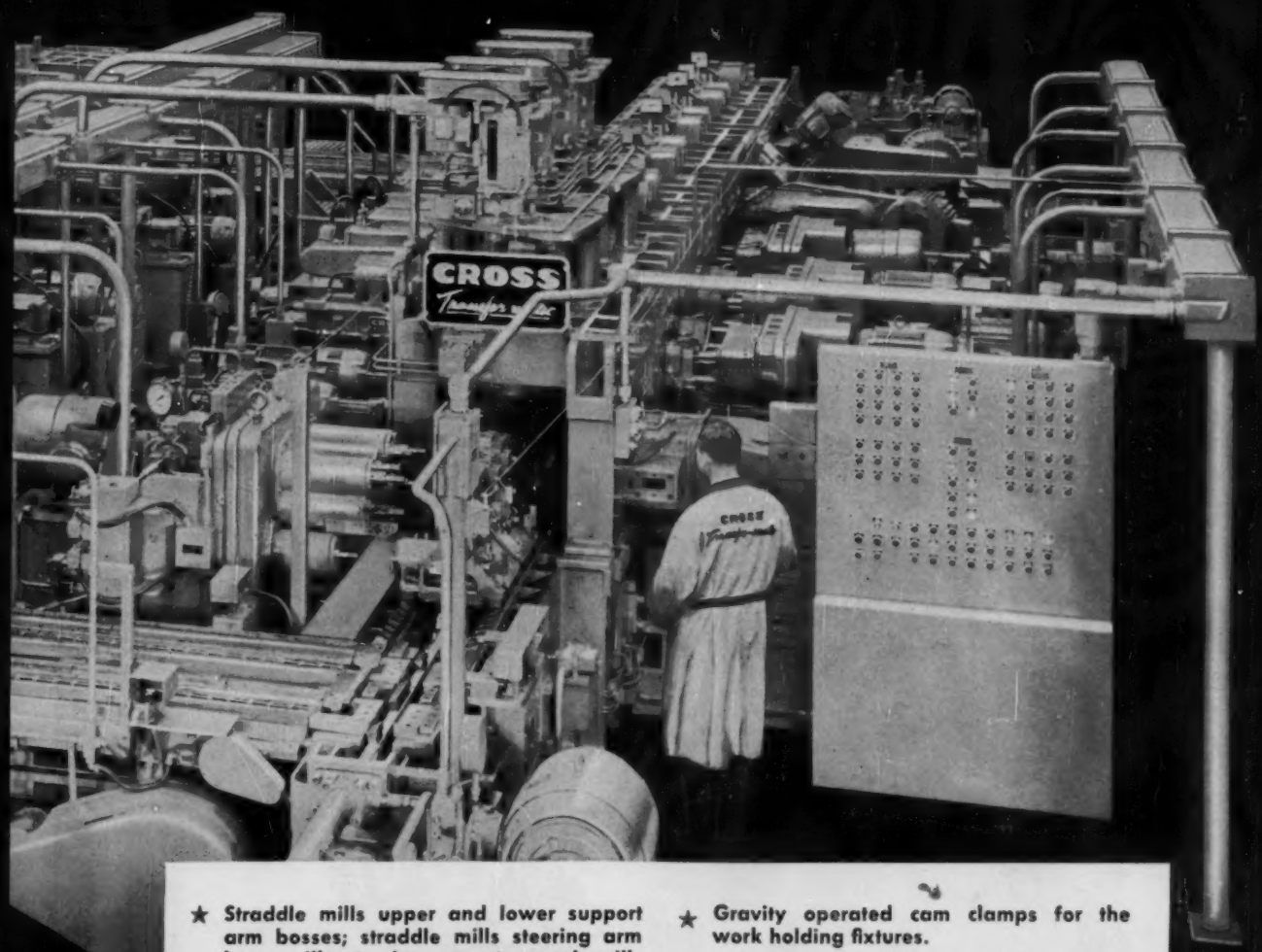
Established 1898

THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

Another Transfer-matic by Cross



- ★ Straddle mills upper and lower support arm bosses; straddle mills steering arm boss; mills steering arm stop pad; mills spindle keyway; drills and taper reams upper and lower support arm holes and steering arm hole; drills, reams, chamfers and spotfaces two brake mounting plate holes; drills, counterbores, spotfaces, chamfers and reams brake anchor hole; drills spindle cotter pin hole; and threads wheel spindle.
- ★ 144 right and 144 left hand parts per hour at 100% efficiency.
- ★ Pallet type work holding fixtures locate parts from spindle bearing diameters.
- ★ Power wrench clamps work holding fixtures automatically.
- ★ Gravity operated cam clamps for the work holding fixtures.
- ★ Automatic transfer mechanism indexes right and left hand parts through all 17 stations in pairs.
- ★ Automatic indexing units turn fixtures 82° at Stations 11 and 17.
- ★ Cross modular unit construction provides flexibility for design changes.
- ★ Other features: construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for milling, drilling and reaming; individual lead screw feed for threading; automatic fixture cleaning unit; complete interchangeability of all standard and special parts for easy maintenance.

VS-100

new all-electric machine tool feed drive

No pick-off gears or gear changes are necessary with the VS-100. Infinitely variable 100 to 1 speed range offers high speeds for rapid traverse as well as the slowest feed rates.

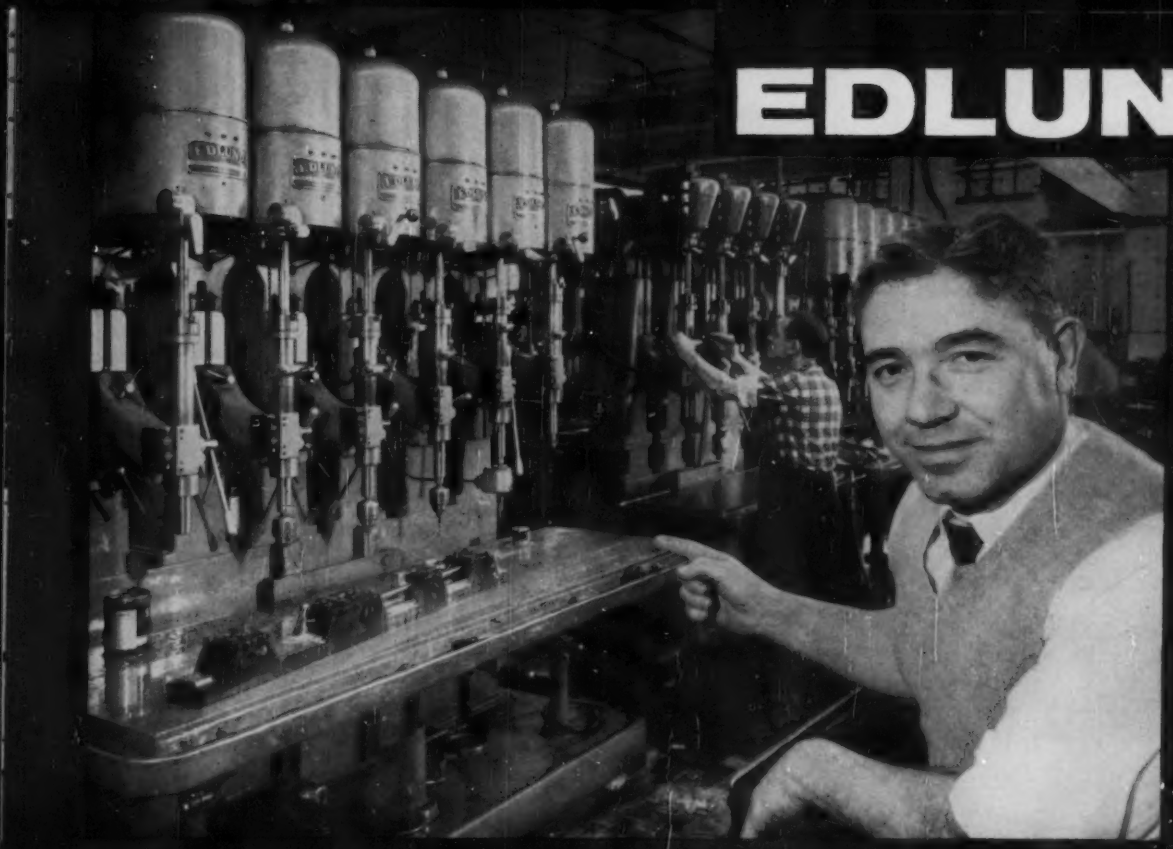
Feeds may be precisely selected and rapidly changed, even during a cut. The push button operator's station provides easy, instantaneous feed control. This remote station contains controls for start, stop, jog, reverse, and speed changing . . . ideal in pendent station mounting for maximum operator's convenience. Additional functions, such as automatic dwell and automatic feed programming are available for the operator's station.

The VS-100 operates from 220 or 440 volt, single phase, a-c. circuits. Seven sizes are available ranging from ½ thru 4 horsepower. For complete details write for bulletin D-2501. D-1540

RELIANCE ELECTRIC AND ENGINEERING COMPANY

DEPT. 303A, CLEVELAND 17, OHIO • CANADIAN DIVISION: WELLAND, ONTARIO
Sales Offices and Distributors in Principal Cities

EDLUND



"EDLUND DRILLING MACHINES DO EVERYTHING WE WANT *With Maximum Dependability*"

At Intertype Corporation, Brooklyn, N. Y., outstanding manufacturers of typesetting equipment for printers, Edlund Model 2F Drilling and Tapping Machines received the following comments, according to an independent reporting agency:

"Down time due to maintenance has been eliminated with big savings in replacement costs"

"We have proved to our own satisfaction that the Edlund Drilling Machines require the least amount of maintenance"

"Constant delivery of horse-power for high precision work on toughest castings and machined parts"

"Greater flexibility of the Edlund Model 2F reduces trial and error in setting machine speeds because we can get correct in-between speeds"

"7 additional Edlund 2F Machines were ordered last year and 6 more are on order now — these plus the 48 spindles already in operation best show our satisfaction"

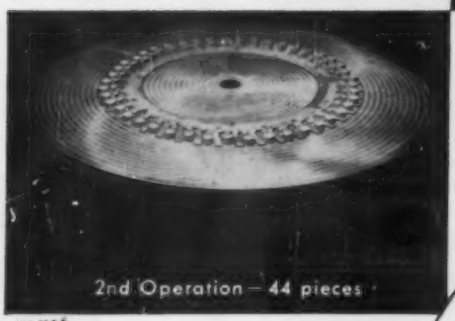
Edlund Model 2F used for precision drilling operations at Intertype Corporation

EDLUND
MACHINERY COMPANY
Cortland, New York
Division of Hanco Corporation

For complete information and specifications about the Edlund Model 2F for your jobs write for Bulletin 140R.

Another example

W-1138



W 1139

# of Blanchard versatility

No. 303 Stainless Steel Forging

653 oddly shaped, non-magnetic workpieces

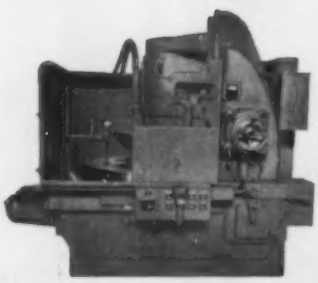
Blanchard Surface Grinders are noted for their unusual versatility—like grinding small, non-magnetic stainless steel forgings in quantity.

In the first operation, 653 forgings are loaded and blocked between rings on a No. 18 Blanchard, with 36" magnetic chuck (stock removal .010"). Parts, chuck and rings are sprayed with oil, and molten sulphur is poured around the parts to hold them. After grinding, the sulphur is easily stripped away.

This entire operation takes only 1½ hours—including preparation of the sulphur.

In the second operation, 44 pieces are set in a notched steel ring. Tilting the wheelhead and maintaining wheel pressure in one direction holds these non-magnetic pieces in the notches. Stock removal from this surface is .030", to tolerance of ±.003. Each load takes eight minutes—floor-to-floor.

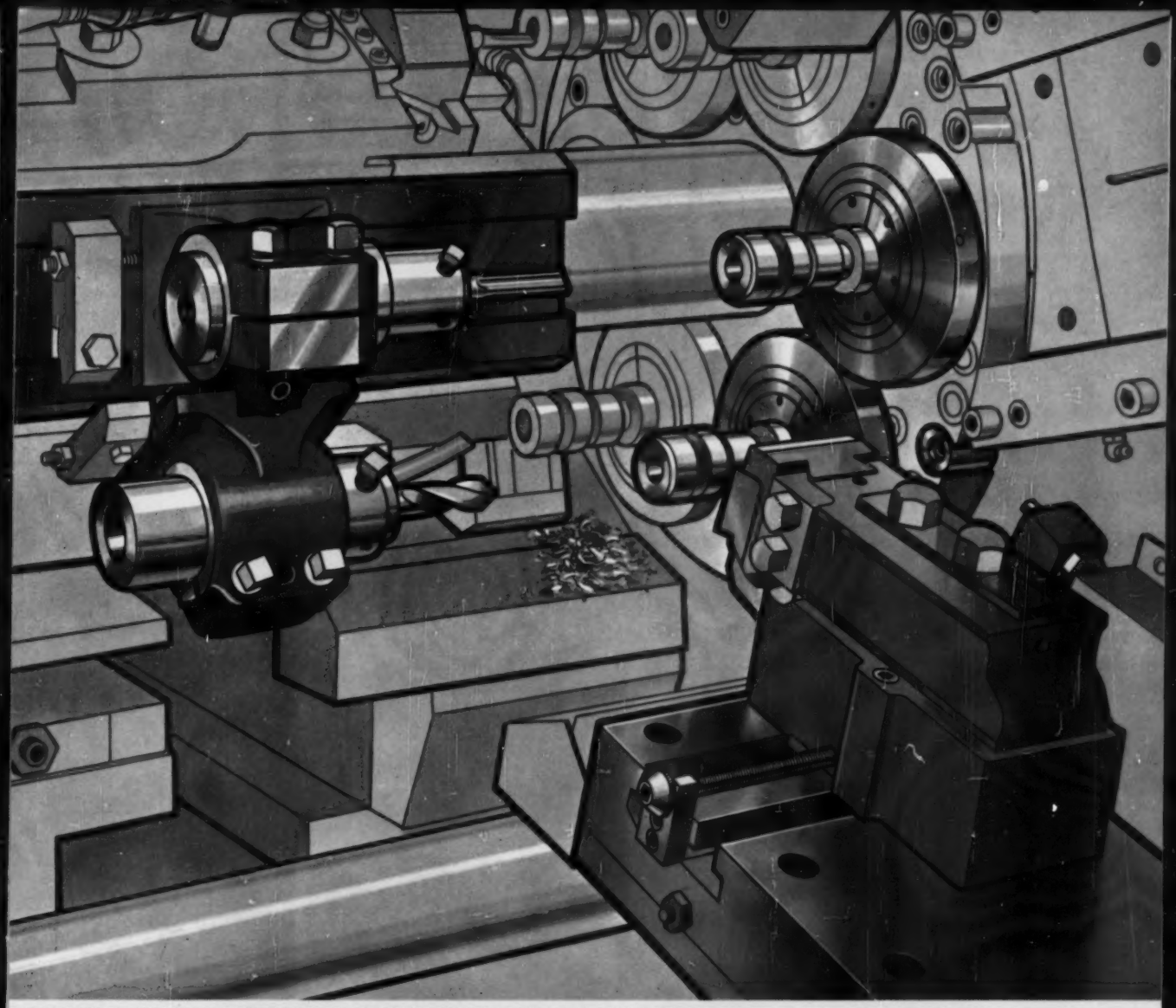
As a result of this ingenious workholding, each piece is ground on both sides in a fraction of a minute, at less than 98¢ abrasive cost for all 653! That's typical of the convenience and economy of grinding on a Blanchard—whether the parts are magnetic or non-magnetic!



Send for free copies of "Work Done on the Blanchard", 4th edition, and "The Art of Blanchard Surface Grinding", 3rd edition—recently revised.

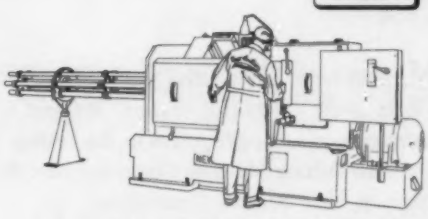
PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY **64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.**

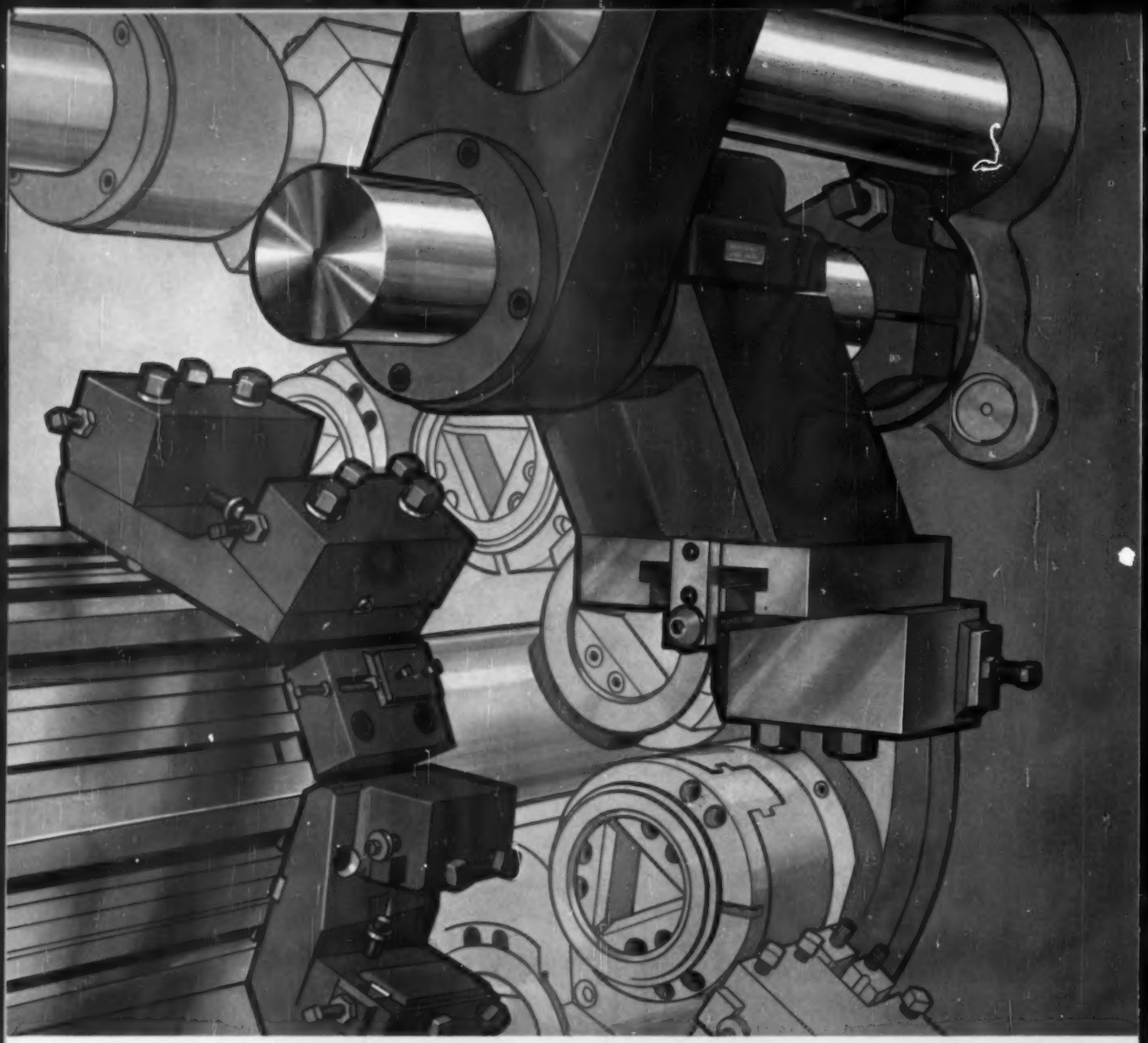


less wear means more profit

New Britain bar machines are "built to stay accurate." Hardened spindle nose cross slides, eccentric cross slide stop buttons and tool slides, plus carrier lifting during index, are only a few of many *exclusive* New Britain features for preserving long-run accuracy. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



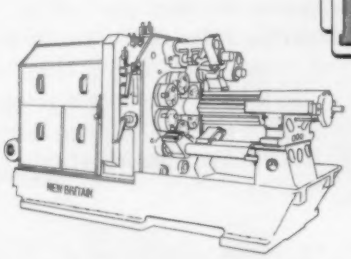
Automatic Bar Machine



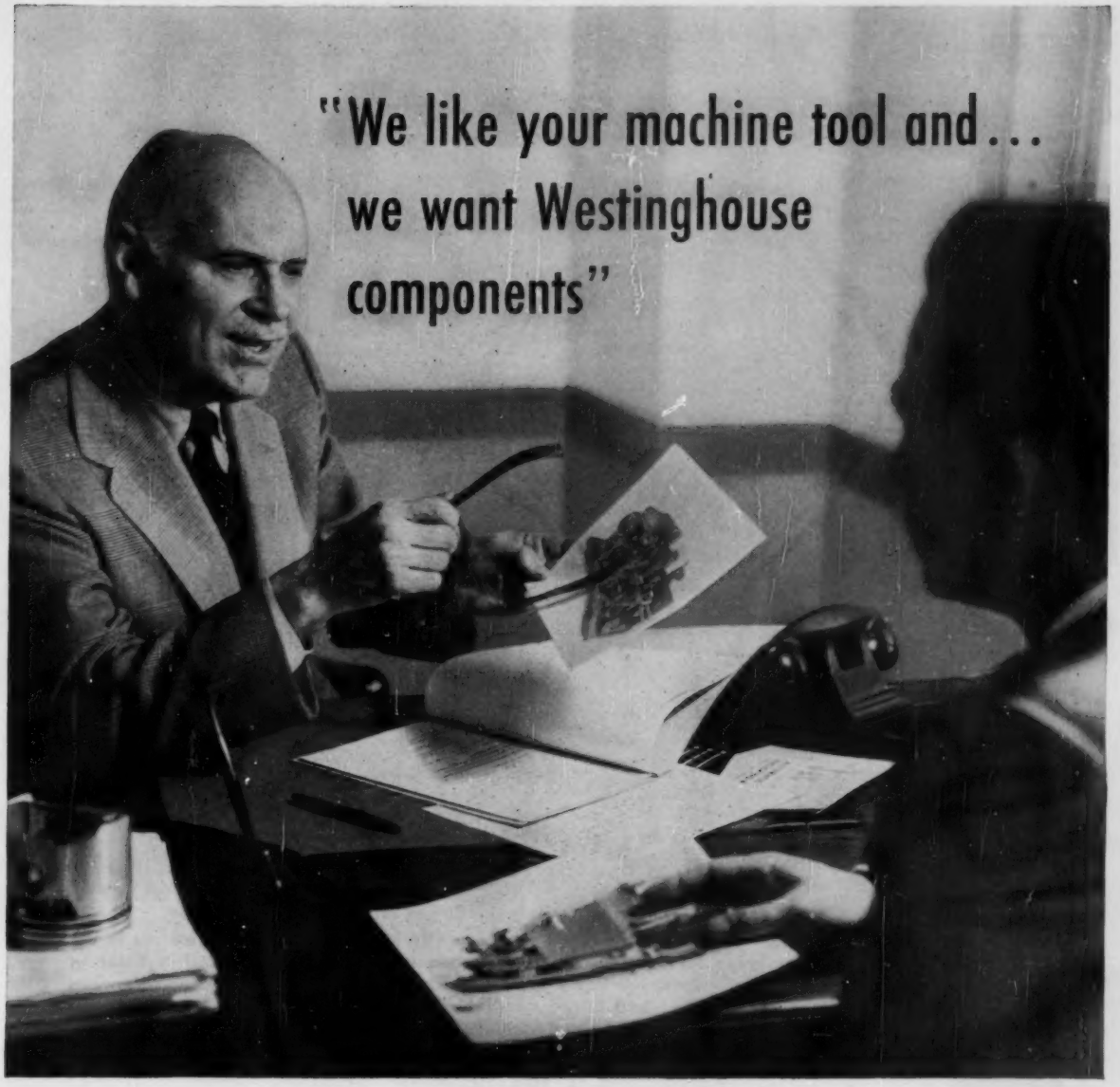
when the job calls for a big, husky chucker

pick a New Britain

New Britains are massive, not only in over-all size and weight, but in every individual feature. Rugged forming arms and tool slides transmit smooth power to the cutting edge in every position. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



Automatic Chucking Machine



A sound decision . . . because getting the most for your machine-tool dollar requires dependable components.

That's why it's good practice to always specify Westinghouse components for your machine tools. They're the result of extensive engineering experience and continuing research aimed at developing units that best serve your equipment.

Westinghouse machine-tool experience in the design, application and servicing of components covers four decades. When you choose Westinghouse . . . you can be *sure*.

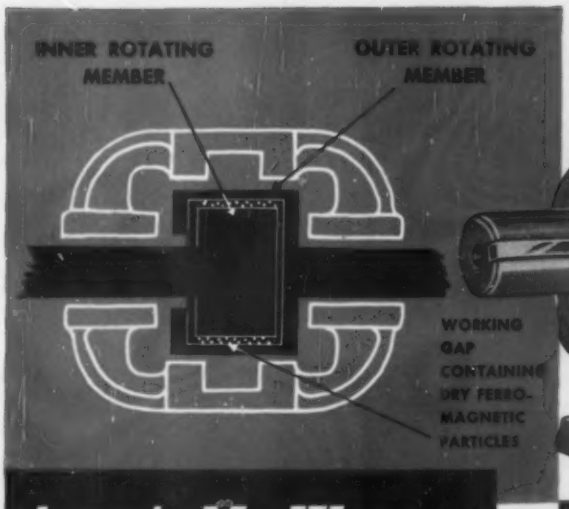
J-96105

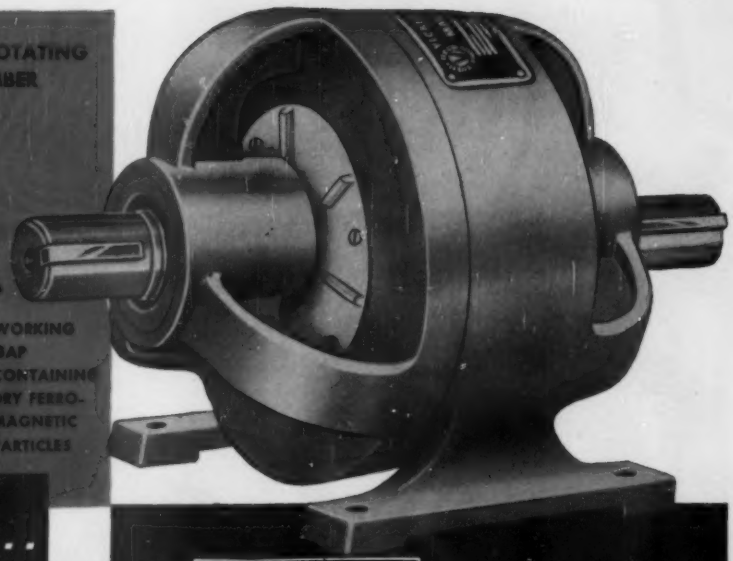
Specify these Westinghouse components when you buy machine tools:

Motors • Controls • Pushbuttons • Gearmotors • Speed Reducers • Adjustable-Speed Drives • Semiconductors • Cypak* Static Control • Rectifiers • Magamp* Magnetic Amplifiers • Instruments • Relays • Machine-Tool Transformers • DYNAC® Magnetic Braking.

*Trade-Mark

YOU CAN BE SURE... IF IT'S Westinghouse





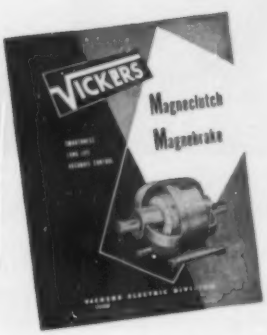
there's No Wear...

in the

VICKERS® MAGNECLUTCH

DRY MAGNETIC-PARTICLE CLUTCH

because there's no mechanical contact between torque transmitting surfaces



Vickers MAGNECLUTCH may also be used for braking and tension control. Get the complete facts. Write today for bulletin and application data forms.

There are no levers or linings—no spring, air or fluid pressures in the Vickers MAGNECLUTCH. Torque is transmitted by the linking action of magnetized finely divided ferromagnetic particles in the gap between driving and driven members. Torque is independent of speed, and is determined by the amount of energizing current. This torque transmission principle provides

CONTROLLED ACCELERATION*
SMOOTH OPERATION
NO GRAB OR CHATTER
LONGER LIFE

Vickers **MAGNECLUTCH** also Offers the Advantage of

TORQUE AT ZERO SLIP—
torque transmitted with 100% mechanical efficiency

TORQUE LIMITING—
torque easily adjustable from minimum to full rated torque

EXTREMELY FAST RESPONSE
SMALL CONTROL POWER
EASILY ADAPTED TO REMOTE CONTROL

*Equally close control of deceleration may be obtained with the Vickers MAGNEBRAKE.

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VICKERS Inc. a unit of Sperry Rand Corporation

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"We grind no axe... and really have no need to." After all, Bliss makes so many types and sizes of metalworking presses—actually many more than any other builder—that we favor only the one right press for your job. It may be a big one, a little one, a mechanical, a hydraulic, a standard or a special. But you can be sure it will be the *right* one.

If you have a pressed metal problem, isn't it logical to talk to a source that's certain to give you an impartial answer? To talk to Bliss?

BLISS
SINCE 1857

E. W. BLISS COMPANY · Canton, Ohio

100 years of making metal work for mankind

PRESSES • ROLLING MILLS • MILL ROLLS • DIE SETS • CAN MACHINERY • ORDNANCE

dixi 60

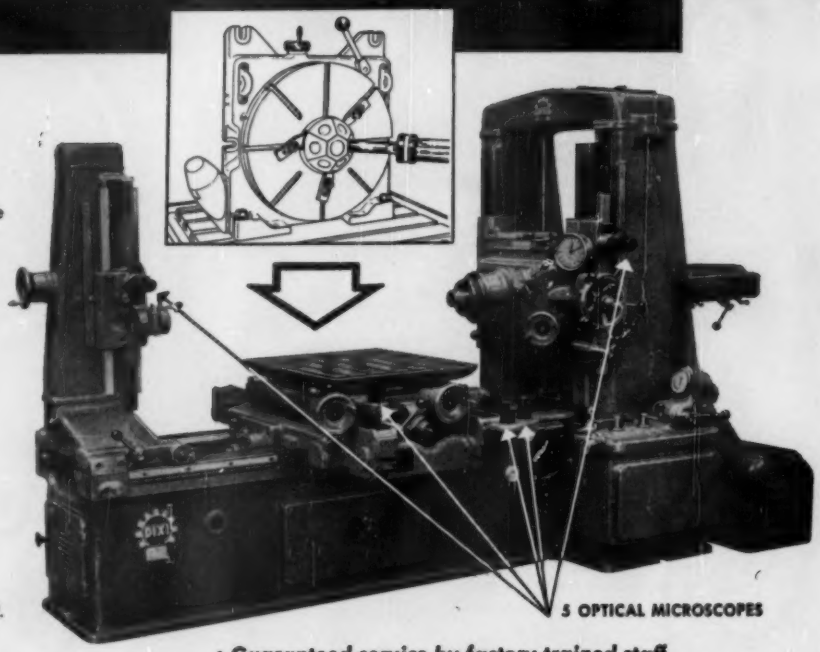
horizontal optical jig borer

with 5 optical microscopes

DESIGNED AND BUILT FOR:

VERSATILITY
Optical settings for operations in all planes and compound angles . . . Equally suitable for tooling, short-run or production work . . .

ACCURACY
Overall accuracy of .0002"



A precision machine for *JIGLESS* boring, facing, milling, and drilling work, in all planes. Built-in 360° optical rotary table, 28¾" x 32¾". All spindle and table settings by optical microscopes. Infinitely variable hydraulic feeds. Mechanical spindle feeds with automatic depth stop. #40 taper spindle-speeds infinitely variable to 1400 R.P.M. Special features eliminate effect of spindle overhang on accuracy.

DIXI 450 PRECISION OPTICAL CIRCULAR DIVIDING TABLE

Direct readings of 1 sec.

(See insert picture above) rigidly mounted (not tilting) on built-in rotary table permits holding close tolerance relations between bores in all planes, including bores at compound angles. ALL IN ONE SET-UP. All sides of the work piece except the mounting face machined in one set-up.

- ***Guaranteed service by factory trained staff***
- ***Engineering staff available for consultation***
- ***Spare Parts in New York stock***
- ***Your operators trained***

DIXI 60 now in wide use in leading Aircraft and Manufacturing Plants throughout the United States.

Names available upon request.

SEE THIS VERSATILE MACHINE IN OPERATION

at our New York or Cleveland Show Rooms. Write for Complete descriptive literature and prices to Department 21. Catalogues on additional production equipment also available on request.

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Our Headquarters in New York City

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Form tool maker reports Norton Grinders...

grind better for less money

MORGOOD TOOLS, INC.
Tools for Automatic Screw Machines

241 BUELL ROAD
P. O. BOX 7 - THURSTON RD. SUBSTATION
ROCHESTER 19, NEW YORK

February 6, 1957

Norton Company
Worcester, Massachusetts

Gentlemen:

Your #1 Tool and Cutter Grinder has proven to have outstanding qualities for grinding circular form tools.

The low initial cost, low maintenance and high accuracy and finish is most beneficial. Graduations on the longitudinal table feed permits rapid and accurate cuts, which facilitate minimum time used in optical measurements. Due to the replaceable heavy cartridge spindle it is possible to make heavy cuts and still retain the desired accuracy and finish after many years of use.

We are very pleased with the record performance of these machines which enable us to furnish the highest finish in our trade.

Cordially yours,

MORGOOD TOOLS, INC.

BJG/bjc

Ben John Goodman

At Morgood Tools, Inc., Rochester, N.Y., a large manufacturer of circular form tools, nine Norton No. 1 Tool and Cutter Grinders have beaten all previous records for efficiency and economy in finish grinding.

The Norton No. 1 Universal Tool and Cutter Grinder is a completely motorized machine that can be supplied in various arrangements — from the simple sharpening of cutters and reamers supported on centers only, to suitability for all sorts of cutter, surface, cylindrical and internal grinding.

Each arrangement has valuable advantages. For example, longitudinal table feed by means of a feed screw and handwheel — instead of competitive methods of using length rods and dial indicators — is ideal for speed and accuracy in circular form tool grinding.

Only Norton offers you such long experience in both grinding machines and wheels — to bring you the "Touch of Gold" that helps you produce more at lower cost.

For further information, see your Norton Representative. Or write for Bulletin 1034 to NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

To Economize, Modernize with NEW

NORTON

GRINDERS and LAPPERS

Making better products . . . to make your products better

NORTON PRODUCTS:
Abrasives • Grinding Wheels • Grinding Machines • Refractories

BEHR-MANNING DIVISION:
Coated Abrasives • Sharpening Stones • Behr-cat Tapes

District Offices:
Worcester • Hartford • Cleveland • Chicago • Detroit

"Engineered Production" Service

FOR BROACHING

It takes all 3

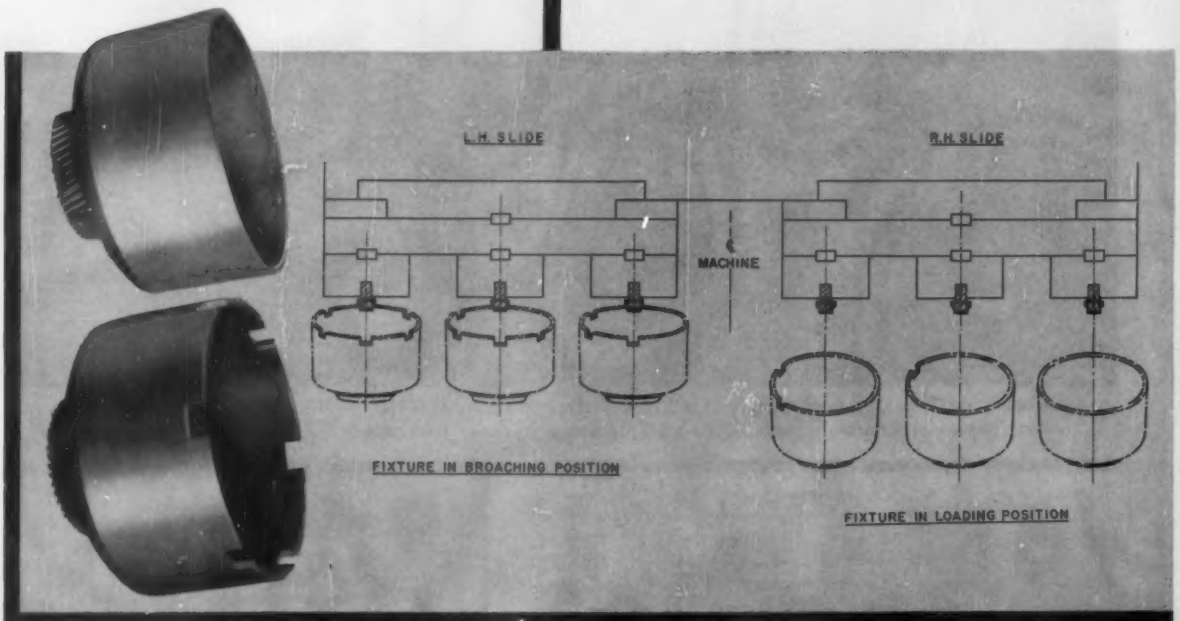
American's *"Engineered Production"* Service . . . gives the broach-user the complete three-part service that is essential to obtain the most practical broaching method. Years of design and production engineering experience, unavailable at any price, are effectively added to your staff at no extra cost.

THE JOB — Broaching six .602 - .606 inch wide, .38 inch deep slots in the face of a 5.5 inch diameter hub. The bottom face of the slot is finished at an angle.

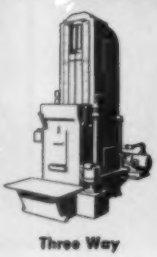
THE RESULT — 150 completed pieces per hour. Two automatically indexing, three-station fixtures hold the six parts. The operator has only to load and unload parts and start machine cycle.

1 PROPER BROACH TOOL DESIGN

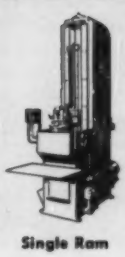
Top-quality results on any broaching operation require starting the job with design of the broaching tool itself. In solving this all-important first step, American Broach considers stock removal, length and width of cut, finish, tolerances required, etc. American's experience in designing and building broaches for every type of part capable of being broached pays off in quality of work and in long tool life. You can be sure the broach and machine will operate as a team because they are designed that way.



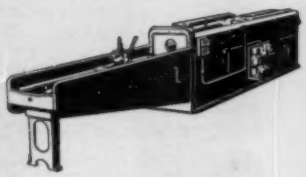
Broaching Tools



Three Way



Single Ram



Horizontal

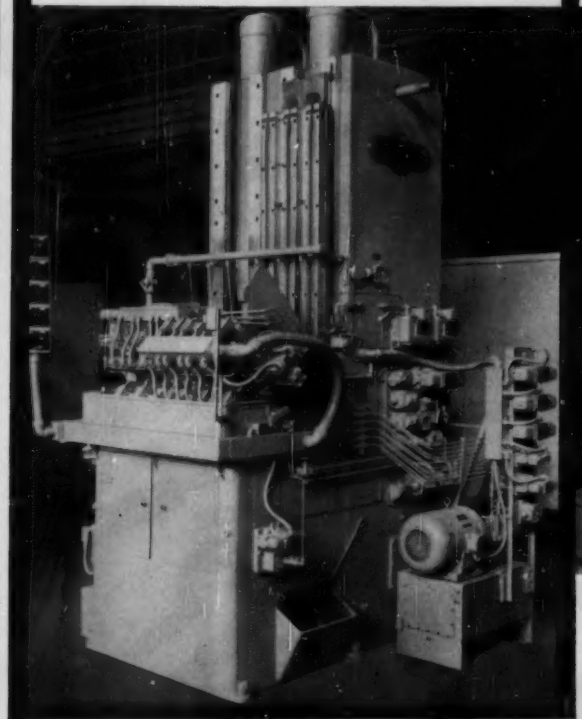
to give you peak broaching performance

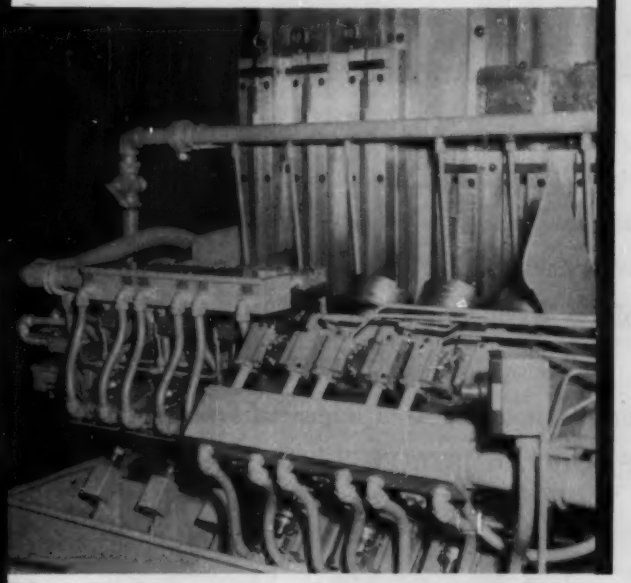
2 SPECIFYING THE RIGHT MACHINE

Production rate required, length and speed of stroke, relationship to other production machinery, and available floor space determine the selection of the broaching machine capable of doing the best job. At American, machine selection follows design of the broaching tool. Because American builds a complete line of standard machines and has extensive experience with specials, you can depend on getting the most practical machine for your job.

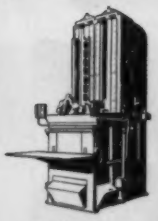
3 EFFICIENT FIXTURING

Whatever your part geometry or hourly needs, fixturing by American Broach forms the vital third link in the production chain. Whether manual loading and unloading is used or the work cycle is completely automatic, work-holding fixtures designed and built by American Broach feature easy loading and unloading coupled with positive clamping during the broaching cycle. Even with relatively inexperienced operators, production schedules are maintained since the "skills" are built into the tool, machine, and fixtures.

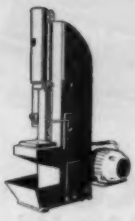




For more information on practical broaching methods write for Bulletin A114.



Duplex Ram



Presses

SUNDSTRAND

American

BROACH & MACHINE DIVISION

SUNDSTRAND MACHINE TOOL COMPANY

ROCKFORD, ILLINOIS

ARMSTRONG
WRENCHES

Types and Sizes for Every Industrial Use

ARMSTRONG Wrenches have engineered designs, a wide safety factor of extra strength, accurately machined openings that go over screw heads or nuts easily, grip firmly —will not slip, round corners or mar faces.

Drop forged from special high tensile carbon and alloy steels, heat treated to an exactly pre-determined balance of hardness, toughness and tensile strength. ARMSTRONG Wrenches will not "chew out," will stand up through years of service, making work faster, easier and safer.

In sizes and types, ARMSTRONG Wrenches comprise the most complete line of industrial wrenches manufactured. Specify "ARMSTRONG" when ordering wrenches.

Write for Catalog

ARMSTRONG BROS. TOOL CO.
5215 W. ARMSTRONG AVE. • CHICAGO 30, ILL.

HOW TO LAND A PRIZE CATCH

If you're casting about for ways to save money and increase your production, then you'll land a prize catch when you hook-on to CIMCOOL°—the radically new and different cutting fluid. Here are just three reasons why you'll want to net CIMCOOL Concentrate:

- **CIMCOOL LOWERS COSTS** because it's longer lasting in machines. Thus, it reduces downtime and cuts labor costs for cleaning and changing.
- **CIMCOOL DOES A BETTER JOB** because of its chemical lubricity. It permits faster speeds and feeds, for it combines friction reduction and cooling capacity in a degree never before attained by old-fashioned coolants.
- **CIMCOOL IS CLEAN,** doesn't soil clothing or hands. It contains no skin irritants. It leaves no slippery film on shoes, floors, machine or work. It can't smoke, can't burn, and virtually eliminates rancidity and foul odors.

So, cast a line in the direction of your CIMCOOL Distributor. He'll give you complete information on CIMCOOL Concentrate— and the entire family of CIMCOOL Cutting Fluids. Or contact us direct. We'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

CIMCOOL CUTTING FLUIDS

CIMCOOL Concentrate—The famous pink fluid which still covers 85% of all metal cutting jobs. Effective, economical and clean.

CIMCOOL Tapping Compound—Permits the use of highest tapping speeds and increases tap life amazingly.

CIMPLUS The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.

CIMCUT Concentrates — For jobs requiring oil-base cutting fluids. Added to mineral oils, they give economical mixes for higher speeds and feeds.

CIMCOOL Bactericide — The most effective agent yet developed to overcome rancidity and foul odors.

CIMCOOL Machine Cleaner — The two-phase non-corrosive cleaner that removes grit, dirt, slime and oil.

°Trade Mark Reg. U.S. Pat. Off.

CIMCOOL Cutting Fluids *for 100% of all metal cutting jobs*

PRODUCTION PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.

Before buying any Tracer Turning Equipment

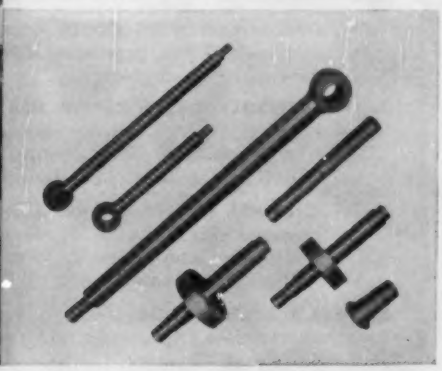
See what you get with **SUNDSTRAND**

"Engineered Production"

FOR EXAMPLE: Production increased 80% on miscellaneous turning jobs!

Here's an example of how one company uses a Sundstrand Tracer Lathe to improve production over previous turning methods. Lot sizes are small, set-up time is short, and production has increased approximately 80%.

Large or small-lot tracer turning—including the jobs that call for heavy cuts—are being handled with unprecedented efficiency on Sundstrand automatic lathes. Substantial savings and a high degree of flexibility in operations are being realized regularly in metalworking plants of every size using the tracer setups best suited to their operations. Ruff, semi-finish, and

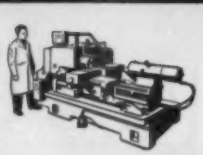


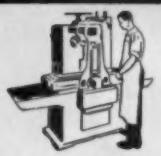
Parts shown above are ruff, semi-finished and finish turned in one automatic multi-cut cycle and with only one template for each part.

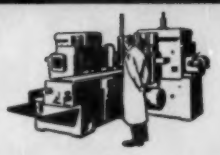
SUNDSTRAND "Engineered Production" Service*

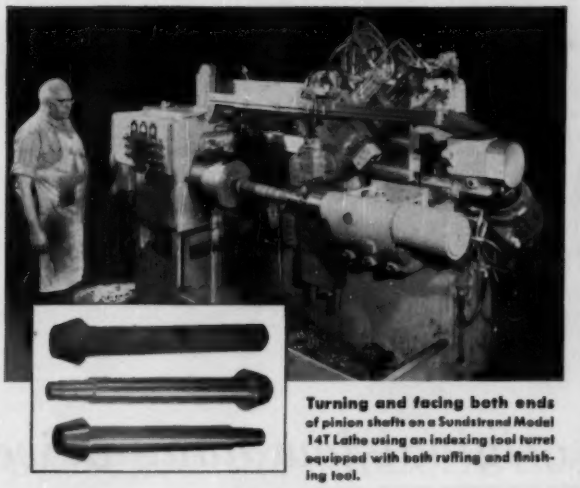
*REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

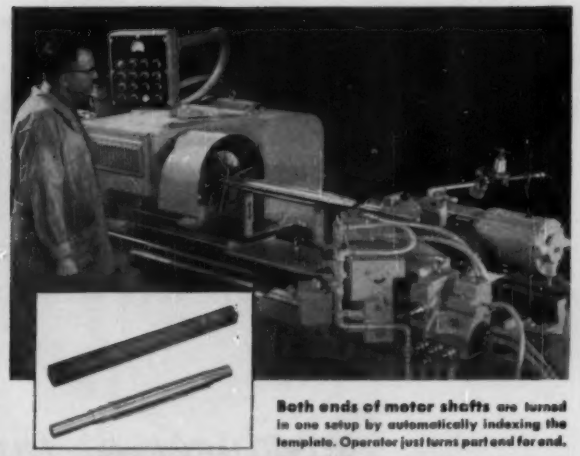








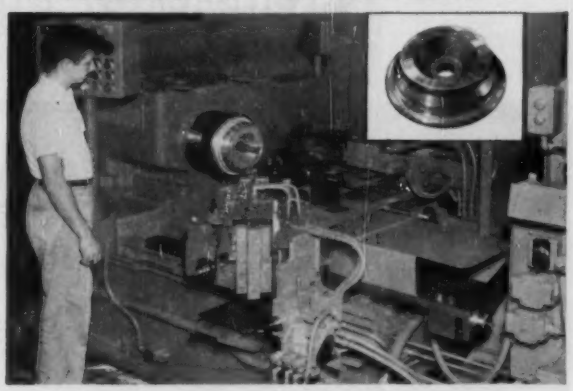
Turning and facing both ends of pinion shafts on a Sundstrand Model 14T Lathe using an indexing tool turret equipped with both ruffing and finishing tool.



Both ends of motor shafts are turned in one setup by automatically indexing the template. Operator just turns part end for end.

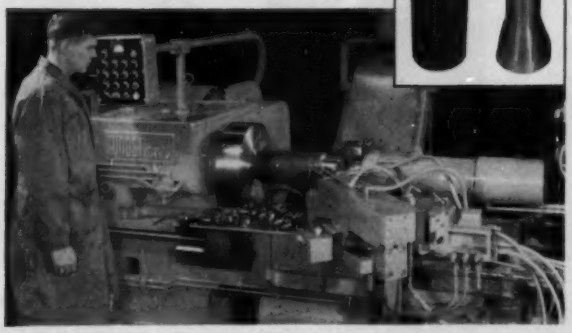
finish cuts can be made in a single automatic cycle using just one template. Lathes can also be provided with ruff and finishing tools in quick indexing turrets or with automatic template indexing where both ends of a part are handled in one machine.

Sundstrand's "Engineered Production" Service assures the selection of the tracer lathe best suited to obtain the most practical turning method for your machining requirements. A complete range of standard, as well as special Multi-Cycle Tracer Lathes are available to fulfill your requirements.



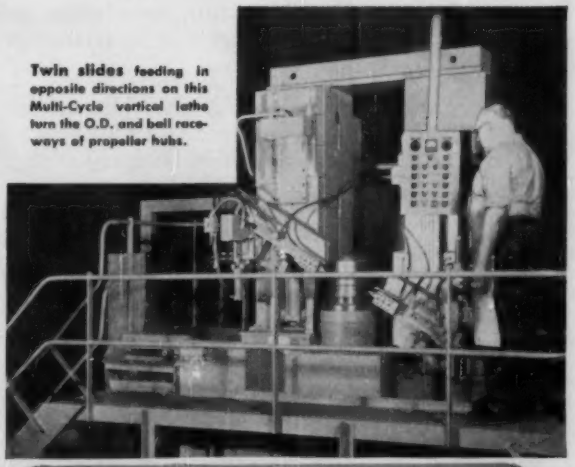
Turning, boring, and knurling the irregular contour of magnesium aircraft wheels.

Additional information on Sundstrand Multi-Cycle Tracer Control is available in Bulletin 179. Write for your free copy today.

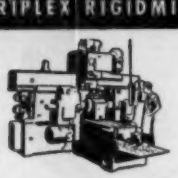


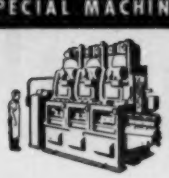
A four cut automatic cycle speeds the heavy stock removal on rock drill parts. Easily adjusted stops control the automatic cycle of this tracer lathe. A hydraulically actuated rear slide grooves the shank end of the part.

Twin slides feeding in opposite directions on this Multi-Cycle vertical lathe turn the O.D. and ball raceways of propeller hubs.



TRIPLEX RIGIDMILS | SPECIAL MACHINES





SUNDSTRAND
Machine Tool Co.
2533 Eleventh St. • Rockford, Ill., U.S.A.

Carlton

producer of the original low hung drive

Check this exclusive combination of Carlton advantages:

Low hung drive: created by Carlton, widely copied but never duplicated.

Wide selection: 5 models and many arm and column sizes.

Greater capacity: broad range of speeds and feeds; practically any combination of tap leads available.

Programming, pre-selector, partial pre-selector or manual speed-feed control.

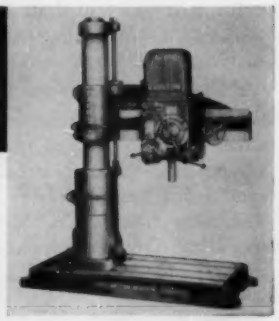
Super-precision column clamp; 360° clamping for 20% more rigidity, greater accuracy.

3-unit power clamping: arm, head and column, for easier and more economical operation.

Positive tooth feed clutch: provides constant feed to the spindle regardless of density of metal.

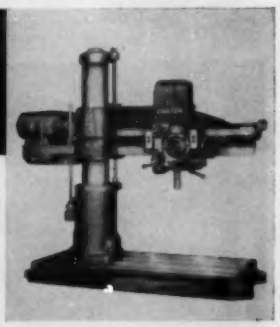
Easy, economical maintenance: only one friction clutch; 100% interchangeability of parts.

0A



A versatile radial drill with hole drilling range from ⅛" to 1¼" diameter. Offers many of the exclusive Carlton design, construction and operating advantages shown at left.

1A



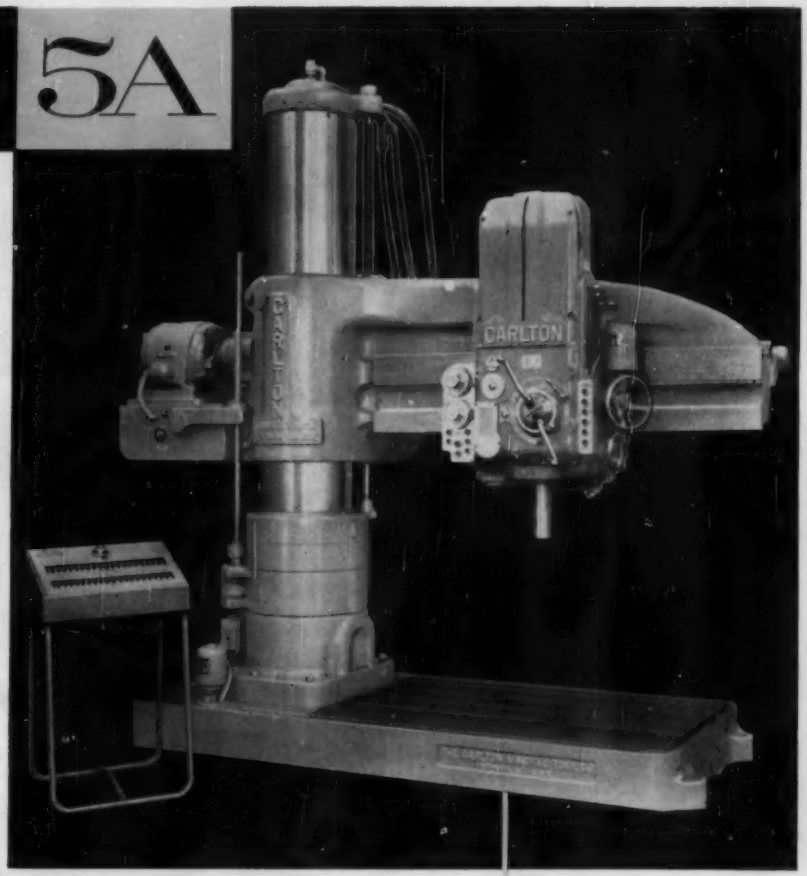
A medium duty radial drill with a hole drilling capacity of ⅛" to 2¼" diameter. Like all Carlton radial drills, the 1A has the super-precision column clamp and the anti-friction mounted head.

Model	Column diameters	Arm lengths	Speeds No.	Speeds Range	Feeds No.	Feeds Range	Motor recommended
0A	9"	3'-4'	9	20 to 1	4	.006-.020	3-hp
1A	9" 11"	3'-4' 3'-4'-5'	12	25 to 1	6	.006-.025	5-hp 5 or 7½-hp
3A	13" 15" 17"	4'-5' 4'-5'-6' 5'-6'-7'	36	100 to 1	18	.004-.125*	7½, 10, 15 or 20-hp
4A	19"	6'-7'-8'	36	100 to 1	18	.004-.125*	15, 20 or 25-hp
5A	22" 26"	7' to 10' 8' to 12'	36	100 to 1	18	.004-.125*	20, 25 or 40-hp

*8, 11½, 14 and 18 threads per inch are standard, with various other combinations available.

presents the modern design radial drill

3A 4A 5A



The 3A, 4A and 5A Carlton radial drills offer you a choice of four speed-feed controls:

Programming for pre-selecting speeds and feeds for an entire drilling program including as many as 20 or 30 operations.

Pre-selector for setting speed and feed for the next operation while machine is still under cut.

Partial pre-selector selects 36 spindle speeds; feeds shifted manually.

Manual to take advantage of Carlton's centralized push button control.

In addition, these three models give you all the exclusive Carlton advantages shown on the opposite page. No wonder leading machine tool buyers say that Carlton is the ONE *modern design* radial drill. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

Carlton

SPECIALISTS IN RADIAL DRILLS

a precision job well done....

by BATH

PROBLEM:

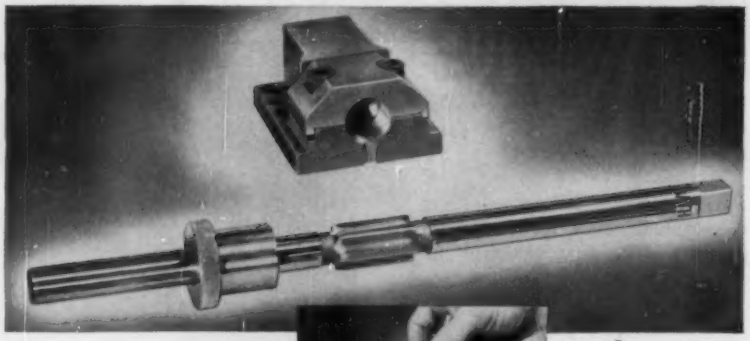
To produce a 1"-32 NEF left hand thread 1½" long to the extremely close pitch diameter tolerance of ±.00115" — thus greatly increasing the precision of the work.

SOLUTION:

A 16" overall 1"-32 NEF pilot tap was manufactured by BATH to thread to the required tolerance.

•

This special 16" Bath tap, threads the feed nut (shown right), which is part of a truing device that controls the grinding quality of precision Internal Grinding machines manufactured by The Heald Machine Co., Worcester, Mass. — a subsidiary of the Cincinnati Milling Machine Co.

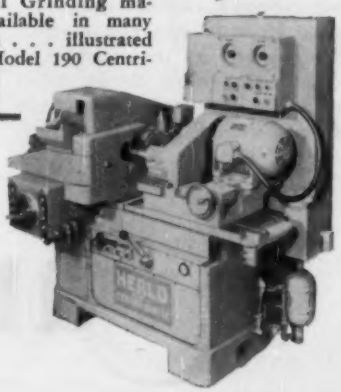


Threads are checked for accuracy with a Bath plug thread gage.

Here's an example of how the cooperative efforts of Bath and Heald engineers succeeded in solving a difficult production problem.

The same service is available to you — as a plus feature that may well save you time and money. Your inquiry will bring full details about Bath taps and gages.

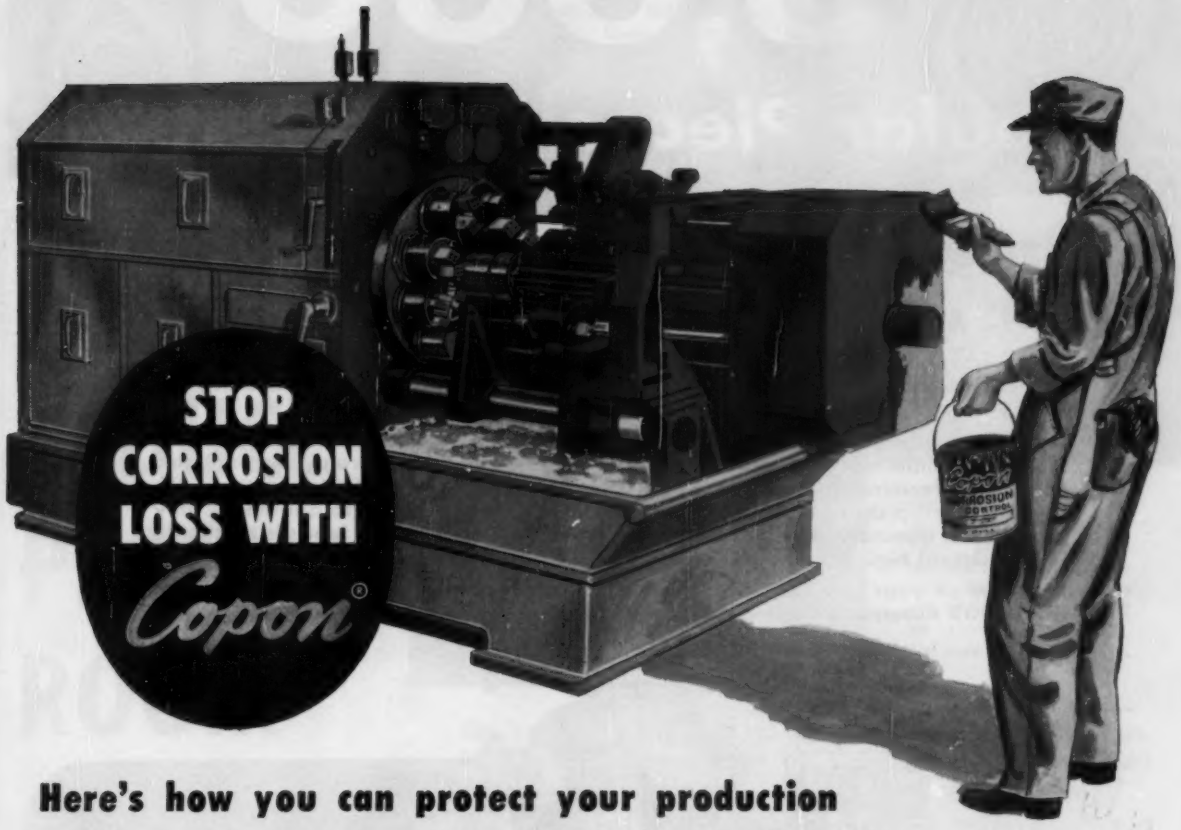
Heald Internal Grinding machines are available in many types and sizes . . . illustrated below is the Model 190 Centri-Matic.



JOHN BATH & CO., Inc.

22 Grafton St., Worcester, Mass.

CYLINDRICAL AND THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS



Here's how you can protect your production equipment from severe metal-cutting coolants

Now . . . a protective coating that will withstand even the stripping action of synthetic coolants. ACTIVATED COPON prevents corrosion damage to expensive machine tools . . . adds years of service life. Just three coats will provide long-lasting protection from constant spillage or complete immersion in coolant mixtures.

COPON coatings offer a ready solution to industry's most persistent corrosion problems. They adhere tenaciously to metal, wood, or concrete surfaces and provide outstanding protection against action of chemical fumes, chemical spillage, salt or fresh water and many other contaminating factors. Each coating is the result of extensive research and careful testing and has been designed to do a specific job.

A complete technical service is provided to assist you in selecting the COPON coating to solve your particular corrosion problem. Write today for details.

COPON is available in a wide variety of colors and may be easily applied by spray, brush, dip or roller coating methods.

Get complete information about COPON. Mail coupon to manufacturer located nearest to your city.

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P. O. Box 1088, Tulsa, Okla.

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Please send me information about COPON Coatings for Corrosion Control.

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AM-5

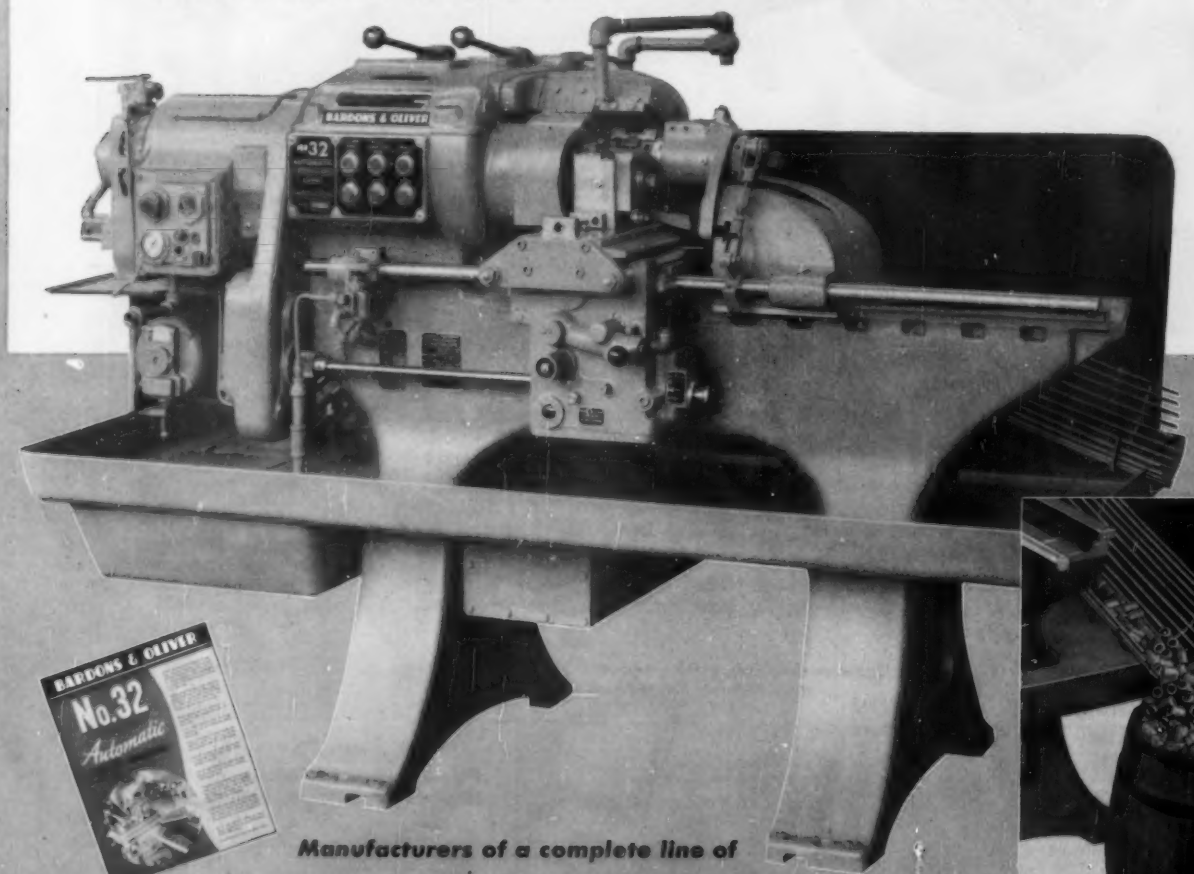
OVER 5,000 Tubular Pieces Per Hour . . .

CUT-OFF and CHAMFERED BOTH ENDS . . . ON THE BARDONS & OLIVER No. 32 *Automatic* CUTTING-OFF *Lathe*

This outstanding machine offers high speed production for both *roller* cutting-off and chamfering on tubular work . . . and *blade* cutting-off and chamfering for solid work.

This single spindle machine represents a substantially lower investment than a multiple spindle machine, yet will produce as many or even more pieces per hour. Some light forming and grooving operations can be performed while cutting-off. Complete setup change from one diameter and length of work to another is only a matter of minutes. A wide range of quick change speeds and feeds is available for consistent high production.

Write us on your company letterhead for literature covering *all* the features of the No. 32 Automatic Cutting-Off Lathe.



Manufacturers of a complete line of
Turret Lathes and Cutting-off Lathes

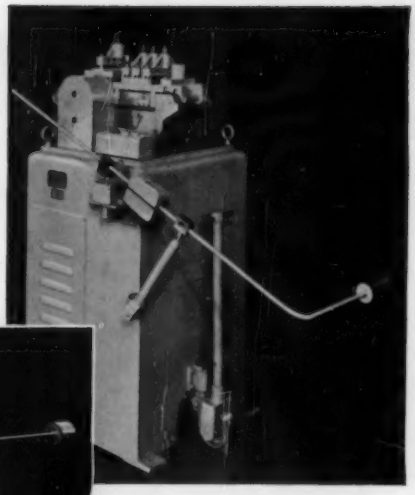
BARDONS & OLIVER, INC.

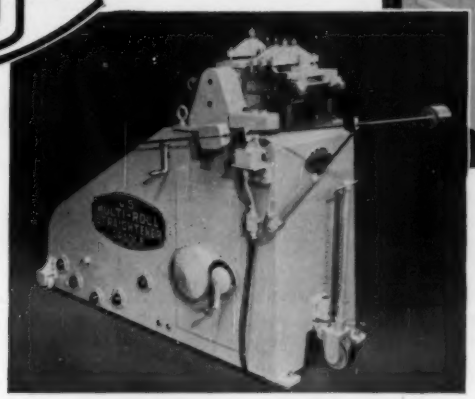
1134 WEST 9TH STREET • CLEVELAND 13, OHIO

USE US PRODUCTS ★

REDUCE PRESS ROOM COSTS

Right: Model PDS-4½ U. S. Power Driven Straightener (portable type) for material up to 4½" wide, ⅛" thick. Equipped with ½ HP variable speed drive motor. Also made in other sizes.



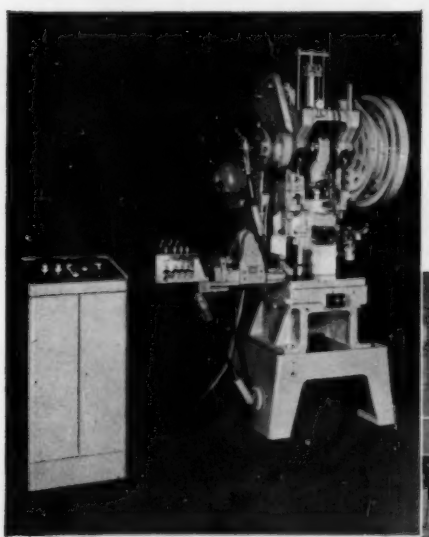


Left: Model PDSC-940 U. S. Combination Coil Cradle and Power Driven Straightener (portable type) for material up to 9" wide, ⅛" thick, coils with OD up to 40". Includes 2 HP variable speed drive motor. Also made in other sizes.

Don't allow inefficient operations to devour your profit margin. U.S. Automatic Press Room Equipment is designed and built to help you effect savings in the production of stampings.

The use of coil stock in your punch press operations should result in very definite savings, and these savings can only be completely assured by using automatic equipment in conjunction with your presses. The illustrations show just a few of the many different units included in the U.S. line for the efficient feeding, straightening and holding of coil stock.

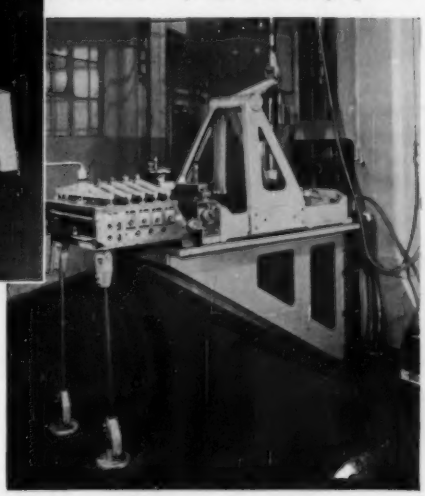
Investigate to see if you are effecting all the cost reductions possible. Ask for a copy of Bulletin 80-A.



Above: Model SF-12 U. S. Mechanically Driven Slide Feed with Plain Straightener for material up to 4½" wide. Shown mounted on a Minster B1-32 High Speed Gap Press.

U. S. TOOL COMPANY, INC.

AMPERE (East Orange) NEW JERSEY



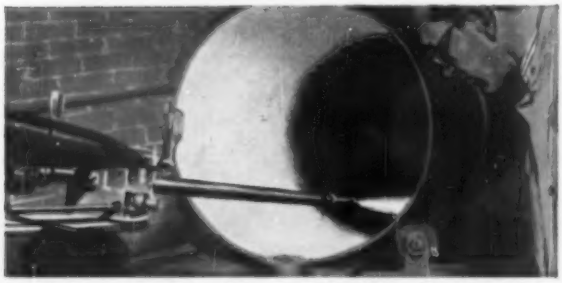
★ **U. S. PRODUCTS**

Slide Feeds
Roll Feeds
Stock Straighteners
Stock Reels
Stock Oilers
Coil Cradles
Wire Straighteners
Die Sets
Multi-Slides ®
Multi-Millers ®

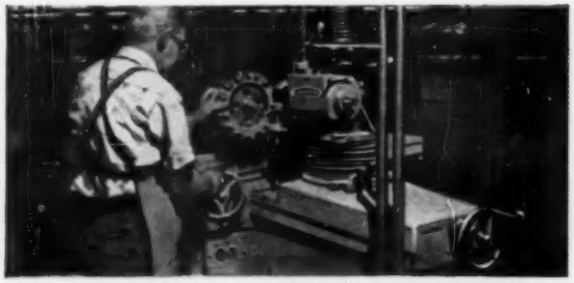
Left: Model SF-24-24 U. S. Mechanically Driven Slide Feed with Plain Straightener for material up to 24" wide. Shown mounted on a Straight Side Press.

10-Ton Pulpstone Chews Up Logs . . . makes pulp for paper products. Norton made the first mammoth pulpstone in 1926; in 1956 most of the world's groundwood pulp was produced by Norton pulpstones.

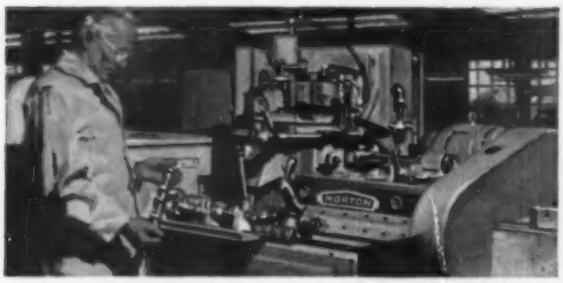
From the mammoth to the



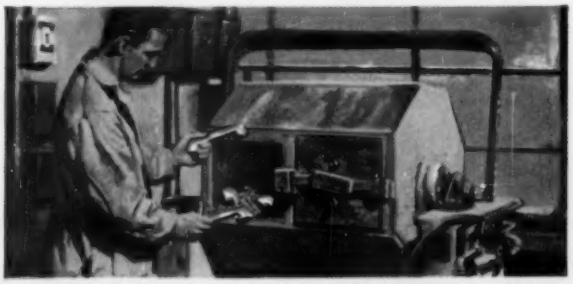
Rokide Spray Coatings protect metal surfaces from high temperatures encountered in jets and rockets. ROKIDE* ceramic coatings are another recently patented Norton development.



Tools for Tools. Norton grinding wheels sharpen the tools that make the product. Here a large milling cutter is sharpened by a Norton grinding wheel on a Norton grinding machine.



Over 1000 Surfaces in an Automobile require grinding to achieve perfect fit and finish. Norton has been an essential supplier to the automotive industry for over 50 years.



Tumbling Act cuts finishing costs. Here Norton TUMBLEX* abrasive is used for precision tumbling. Norton is a pioneer in modern barrel-finishing materials and techniques.

Making better products...

Tiny Rokide Grinding Wheel finishes ball bearing bore no larger than a pinhole. This spindle-type grinding wheel is only .040" in diameter.

tiny through the busy years

It's surprising how many different kinds of abrasive wheels the world needs.

Here one wheel chews logs into pulp — the other polishes holes of pinhole size in miniature bearings. Both are examples of Norton Company's broad scope in supplying abrasives to industry.

Did you know that Norton Company makes more than 200,000 different kinds and sizes of abrasive products — and that it has a continuous improvement program for all of them? The mammoth Norton pulpstone was a "first" in 1926. The miniature ROKIDE grinding wheel was a "first" in 1956. Between the two are literally hundreds of "firsts" that helped some one industry or some one manufacturer make an improvement or cost reduction in product or process.

That's why Norton sees its job as "making better products to make your products better."

NORTON
ABRASIVES

Machines Obey Men. SWIVALIGN* electronic equipment on many Norton grinding machines automatically sets taper tolerances as dictated by the operators — closer than eyes can see.

Across the world and still expanding

Abrasive and Grinding Wheel Plants—Worcester, Mass.; Santa Clara, Calif.; Hamilton, Ontario; South Africa; England; France; Germany; Italy; Brazil. **Behr-Manning Plants**—*Coated Abrasives and Behr-cat Tapes*—Troy, N. Y.; Canada; Australia; France; Northern Ireland; Argentina; Brazil. **Electric Furnace Plants**—Huntsville, Alabama; Chippawa, Ontario; Cap-de-la-Madeleine, Quebec; Brazil. **Grinding and Lapping Machine Plant**—Worcester, Mass. **Refractories and Electro-Products Plant**—Worcester, Mass. **Norton Pike Plant**—*Sharpening Stones*—Littleton, New Hampshire. **Bauxite Mines**—Bauxite, Arkansas.

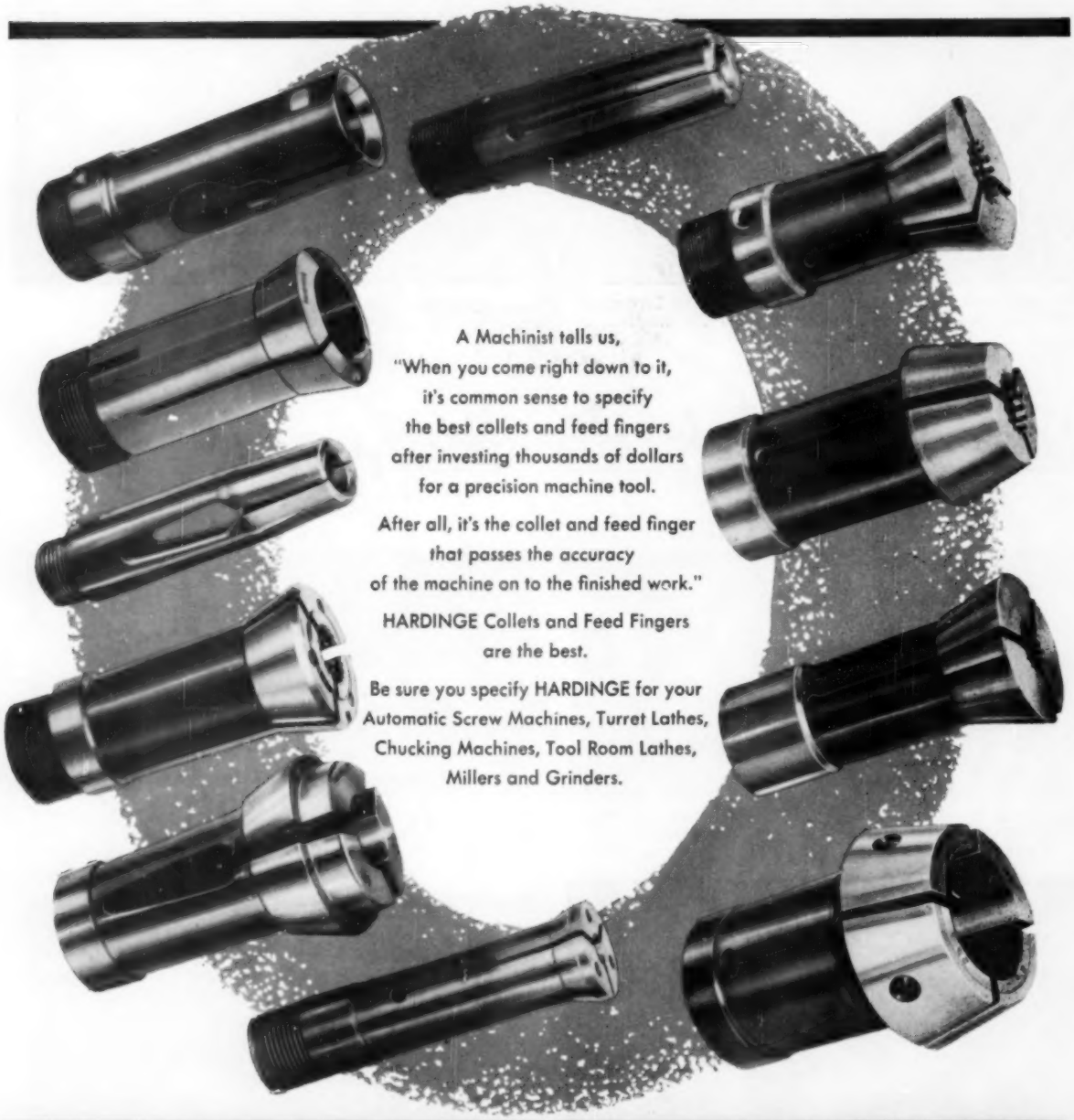
General Offices: Norton Company, Worcester, Mass.

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

to make your products better

Specify HARDINGE ELMIRA, N.Y. **Collets and Feed Fingers**

and *Get the MOST from your Investment in Machine Tools*



A Machinist tells us,
"When you come right down to it,
it's common sense to specify
the best collets and feed fingers
after investing thousands of dollars
for a precision machine tool.

After all, it's the collet and feed finger
that passes the accuracy
of the machine on to the finished work."

HARDINGE Collets and Feed Fingers
are the best.

Be sure you specify HARDINGE for your
Automatic Screw Machines, Turret Lathes,
Chucking Machines, Tool Room Lathes,
Millers and Grinders.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

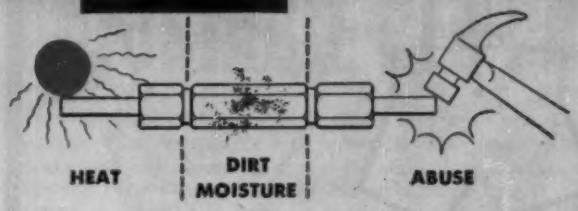
"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Immediate stock delivery from Elmira, Boston, Dayton, Chicago Minneapolis, St. Louis, Detroit, San Francisco, Los Angeles, Philadelphia, Hartford, N. Y.

MAKE GAGES LAST LONGER!

*offered by Size Control Company as a service for our thousands of satisfied customers and friends.**

DON'T



- X Don't force a gage into or over the part being checked.
- X Don't lay gages on metal benches, machines or dirty surfaces.
- X Don't clean gages in water, soluble solutions, kerosene or carbon tetrachloride—all cause rusting.
- X Don't spin parts on or off gages. This induces rapid wear.
- X Don't lay gages in the sunshine—expansion will cause errors.
- X Don't use gages that fit loosely. Know the "feel" of proper gaging.
- X Don't use gages that show visible burrs, nicks or other irregularities, and REMEMBER—reversing the plugs, end for end, and careful removal of a small segment of the leading edge when it becomes worn will provide up to six times longer useful life!

We'd like to discuss your gage needs and have your gage orders. Our engineering representatives are located in all principal cities. Write or telephone us today.

*Reprints of this ad printed on heavy coated stock are available at no charge for posting in your inspection department or laboratory.

DO

PRECISION
Originators of
REVERSIBLE THREAD GAGES

- ✓ Learn how to properly hold and use your gages. Fit must be snug and smooth. Make wooden, felt covered gage racks. Oil the felt surface. This helps to keep your gages clean.
- ✓ Roll or twist the gages into the work slowly to get the proper feel.
- ✓ Check every gage against the master gages before using, at least once on every shift and before returning to the tool crib.
- ✓ *Include gaging expense as part of manufacturing budget. Quality product companies now do this.*

. . . AND insist on *all* of these quality features when you buy new gages:

- *Reversible Plugs* . . . enable you to cut off worn tips at each end—use new section exposed for six to eight times more wear life.
- *Entire Plug Surface Usable*—straight untapered pieces provide uniform gaging surface over entire length—finish to 1.5 microinches RMS or less for maximum amount of wear life.
- *Pin-Vise Aluminum Handle*—positive locking; plugs can't slip. Easily loosened for replacing or reversing plug. Plug length adjustable for different hole depths.
- *Easy Recognition*—GO in green finish; NO GO red.
- *Special Hardening*—plugs hardened throughout . . . enables you to grind down to smaller size . . . gives greater economy.

SIZE CONTROL COMPANY

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Creators of the Centerless Lapping Machine and originators of reversible thread gages.

DROODLES

by ROGER PRICE

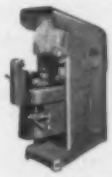
"WELL-DRESSED COMPASS"

This delightful Droodle was inspired by an old photo of my Uncle Fred, showing him all togged out and rarin' to go in the 1924 Olympics in Constantinople. This disconcerted everybody, because the Olympic Games were being held in Paris. The explanation was that Fred had overdone things at a bon-voyage party with friends, and was tossed onto the wrong ship. Furious with embarrassment, he embarked on an epic binge involving pizza and beer. This barred him from the hop-skip-and-jump event, of course. But by exerting a little pull he wangled his way onto the tug-of-war team and heaved his way to a glorious victory.

While we're chatting here, I'd like to give you a few facts about the Jones & Lamson Optical Comparator, which can help you set new records for inspection efficiency. This marvelous instrument measures and inspects all sorts of work pieces and components, in a variety of sizes and shapes. The J & L Comparator is rapid, and accurate to .0001"; and it's so flexible, you'll be able to perform inspections that just aren't possible by any other method. Available in eleven different models, both bench and pedestal types. Write Dept. 710 today for complete information.

Bench Model BC-7D

Floor Model FC-30



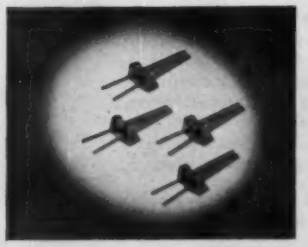
Floor Model FC-14

Table Model TC-14
(Vertical Inspection)

JONES & LAMSON OPTICAL COMPARATORS *On the Job . . .*

at Commercial Centerless Grinding Co., Cleveland, Ohio

This company, a well-known manufacturer of precision instrument parts, has been using J & L Comparators for years, to insure top quality control. A typical inspection piece is this valve pin, 3/16" hex., #416 stainless steel, which is rapidly and accurately inspected after each grinding operation, and then checked out after final grinding.



"The originator of machine tool standards in optical inspection"

JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, Dept. 710, 502 Clinton Street, Springfield, Vt., U. S. A.

Please send me Comparator Catalog 402-C, which describes the complete line of J&L Optical Comparators.

name _____ title _____ street _____

company _____ city _____ zone _____ state _____

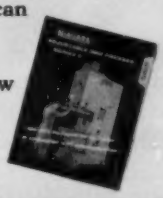
specialized, stylized, modernized for automotive and appliance industries

THE LATEST WORD IN ADJUSTABLE BED PRESSES

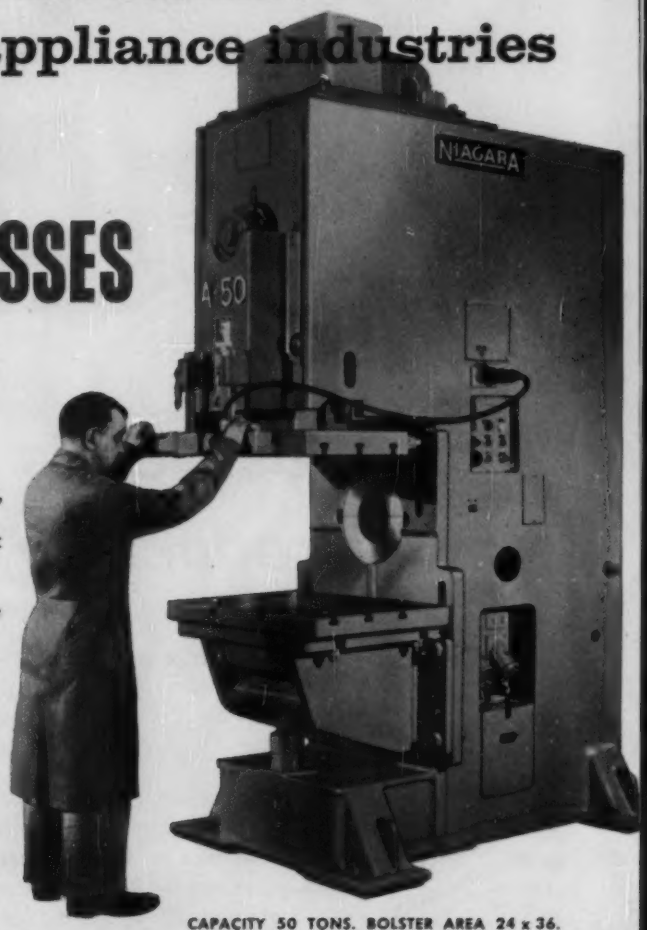
Trim, compact and versatile — this is Niagara's brand new version of its Adjustable Bed Press for the mass production industries. Designed for secondary operations between automated presses in the production line, it embodies specialized features for automotive and appliance manufacturers.

Everything about this press is geared to promote faster, safer and more efficient operation . . . the smooth streamlined exterior of its modern front-to-back crankshaft design . . . absence of overhanging and protruding parts . . . complete drive (gears, flywheel, air friction clutch and brake) fully enclosed within frame . . . up-to-the-minute controls and devices neatly recessed in the frame or completely housed behind flush panel doors.

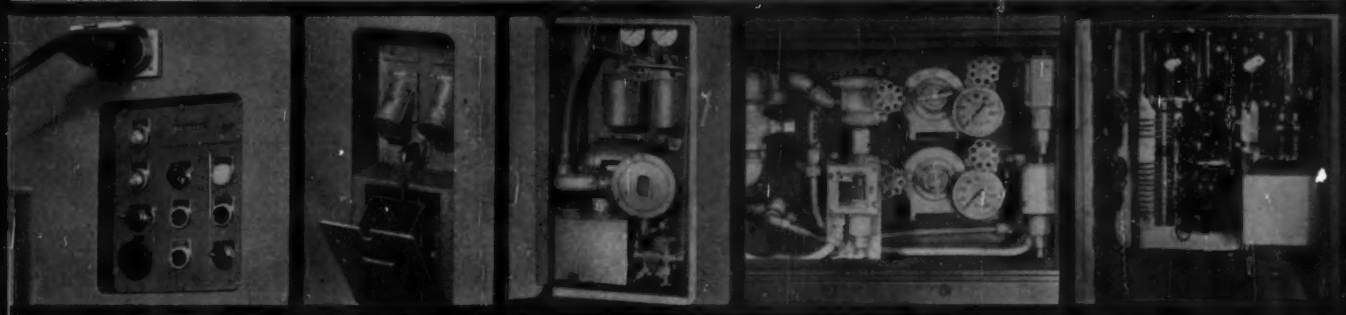
Examine it. No press in this category can match such a combination of design and operating features . . . such space-saving compactness. It's easily moved too! With lifting lug and skid type feet, you can readily hoist or pull this press to any location within your plant.



WRITE TODAY for full details on this new model, as well as the complete standard line of Niagara Adjustable Bed Presses . . . (14 to 150 ton capacities). Request new Supplement and Bulletin 60E.



CAPACITY 50 TONS. BOLSTER AREA 24 x 36.



OPERATOR'S PANEL features deluxe controls conveniently arranged for fingertip direction of press operations.

AUX. POWER SUPPLY & SAFETY BLOCK. Receptacles (440V. and 110V.) for automatic equipment, conveyors, portable tools, etc. Safety plug, chained to safety block, de-energizes entire press control when removed from receptacle.

AUTOMATIC OIL CIRCULATING SYSTEM sends clean, filtered, metered flow of oil to all bearings and gears in crown, air counterbalance, slide gibs and barrel adjustment. Correct operating oil pressure is maintained, or press stops automatically.

AIR CONTROL PANEL houses air line filter, pressure regulators, gauges, blow-off valves for clutch and counterbalance, flywheel brake and motor cutout switch behind dust-tight door.

COMB. MOTOR & PRESS CONTROL in dust-tight enclosure flush mounted in rear frame, houses disconnect switches, circuit protection, transformers, fuses, control relays and starters for main motor and lubrication pump.

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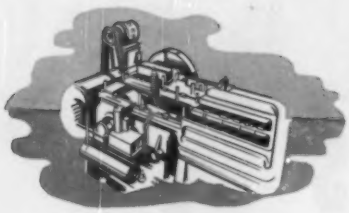
Distributors in principal U.S. cities and major foreign countries

America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work.



"For three weeks their production was zero"...

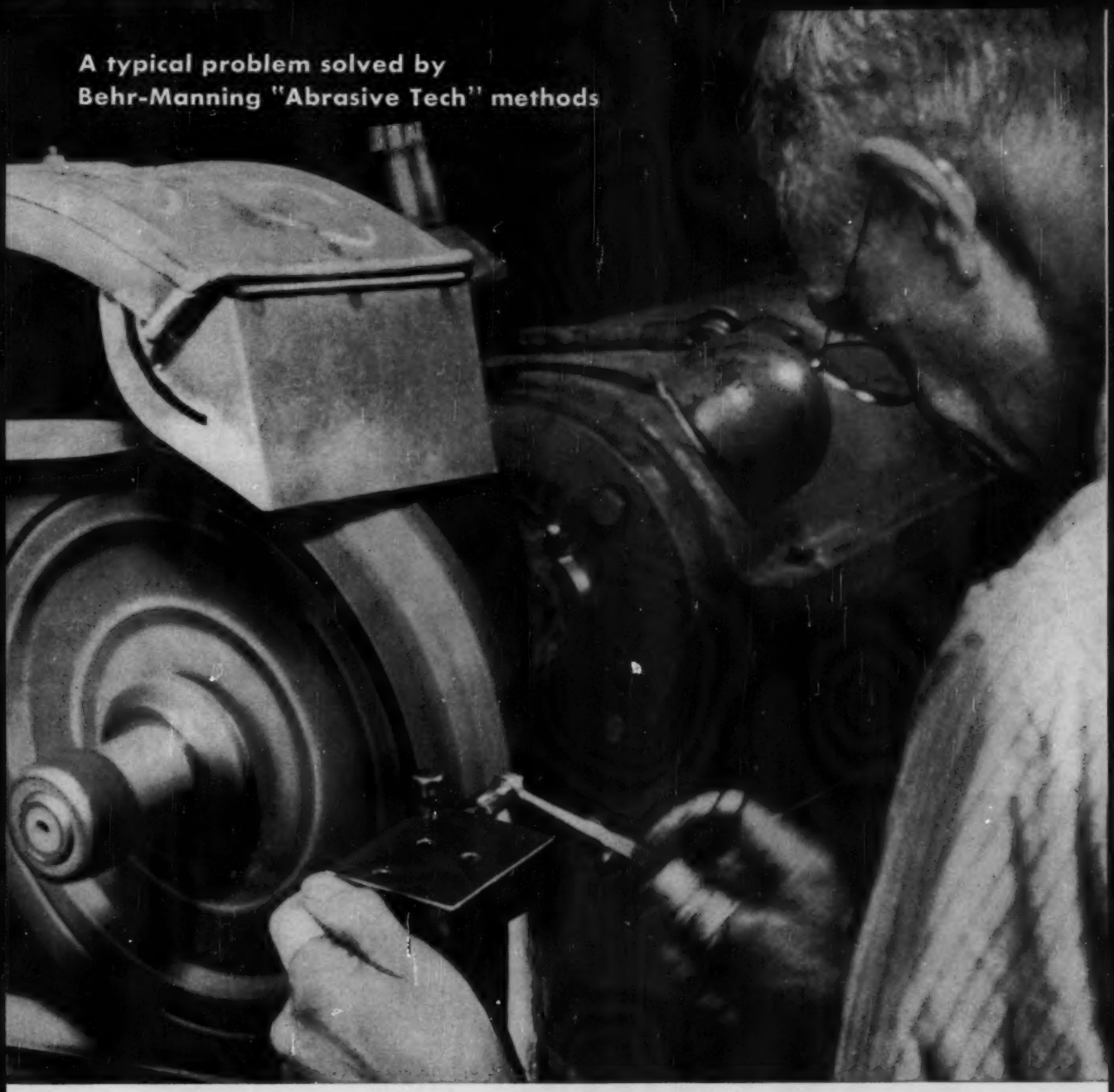
A midwest plant was faced with a serious production problem in aluminum extrusion. The operation, on a ⅜" cold upset extruder, was to form a clinching cap for a metal screw. In three weeks of experimentation they did not produce one acceptable product, although they had tried a variety of piercing tool lubricants, including both oil and wax.

The plant foreman called in J. V. Ritz, a Sinclair Area Engineer. Mr. Ritz reports: "After studying their lubrication problem, I decided that Sinclair TRUKUT,® used in the neat form, would provide the correct lubrication. Three hours after they followed this advice, their machine was producing perfect caps at full capacity. *In fact, they produced more caps in a twenty-minute run than had been produced in the previous three weeks.*"

If you have a lubrication problem in your machining operation, call on the experience of a Sinclair Lubrication Engineer. Contact your local Sinclair Representative, or write to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. *There's no obligation.*

SINCLAIR

CUTTING OILS and COOLANTS



Here's how production jumped 23%: The outside diameter of the box end of this wrench is being polished with a simple fixture and one pass on a Metalite coated abrasive belt. The result of this "Abrasive Tech" method is fast, consistent polishing, since rotation and pressure of the wrench against the belt are always uniform.

Very often a Behr-Manning methods engineer can provide a helping hand with different finishing problems. Just call the nearest Behr-Manning office for a date. There are 17 well-equipped "Abrasive Tech" Methods Rooms, available for problem-solving, or helping finishers brush up on new techniques: Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Grand Rapids, High Point, Indianapolis, Los Angeles, Teterboro, Camden, San Francisco, Seattle, St. Louis, and Brantford, Canada. Main office and plant, Troy, N. Y. For Export: Norton Behr-Manning Overseas, Inc., Troy, N. Y., U.S.A.

BEHR-MANNING CO.

A DIVISION OF NORTON COMPANY

NORTON ABRASIVES

BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Behr-cat Tapes
NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories

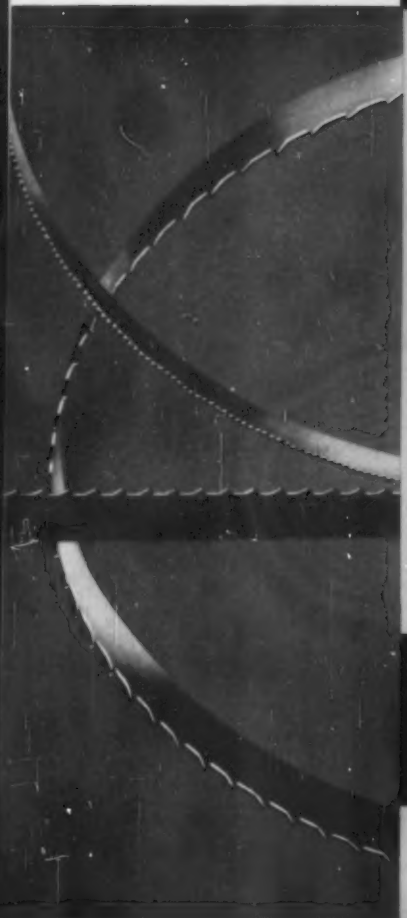
BEHR-MANNING ®

Great in its day...

BUT WOULDN'T YOU
RATHER HAVE
THE LATEST
TECHNICAL ADVANCE?

Now! An important new improvement in metal cutting

Heller *"Job Tempered"* Metal Cutting Band Saws



Certified by American Standards Testing Bureau* to meet their standards for Superior Cutting — Uniform Teeth... Uniform Set... Uniform Temper

When band saw machines are equipped with the *right* blade from Heller's brand new line of metal cutting band saws they give exceptionally fast clean cuts — at minimum unit cost — on a wide variety of materials and for long service periods.

Users report these better results because *every* Heller blade is JOB TEMPERED. Steel of a special controlled-analysis specified by Heller metallurgists, is heat treated by a unique process *matched to the steel.* This insures uniform temper and cutting qualities that mean unsurpassed performance on the job.

Teeth are made uniform in size, shape and spacing by machines of specialized design — the most modern in the industry.

Uniform set is made absolutely *certain* by a highly sensitive indicator developed for just this purpose.

Because of these improvements in the art of band saw manufacture, American Standards Testing Bureau gives its assurance that Heller's great new line of saws meet their standards for superior cutting: uniform teeth — uniform set — uniform temper.

Why not put these exceptional blades to work earning for you?

* AMERICAN STANDARDS TESTING BUREAU INC. S TB

HELLER TOOL CO. SINCE 1836

Heller

HELLER TOOL CO., *America's Oldest File Manufacturer*
Newcomerstown, Ohio — A Subsidiary of Simonds Saw and Steel Co.

YOU GET THESE HELPFUL EXTRAS WHEN YOU USE HELLER BLADES

SOLD *EXCLUSIVELY* THROUGH

Heller DISTRIBUTORS
"YOUR OUTSIDE TOOL ROOM"
Heller "Job Tempered" Tools

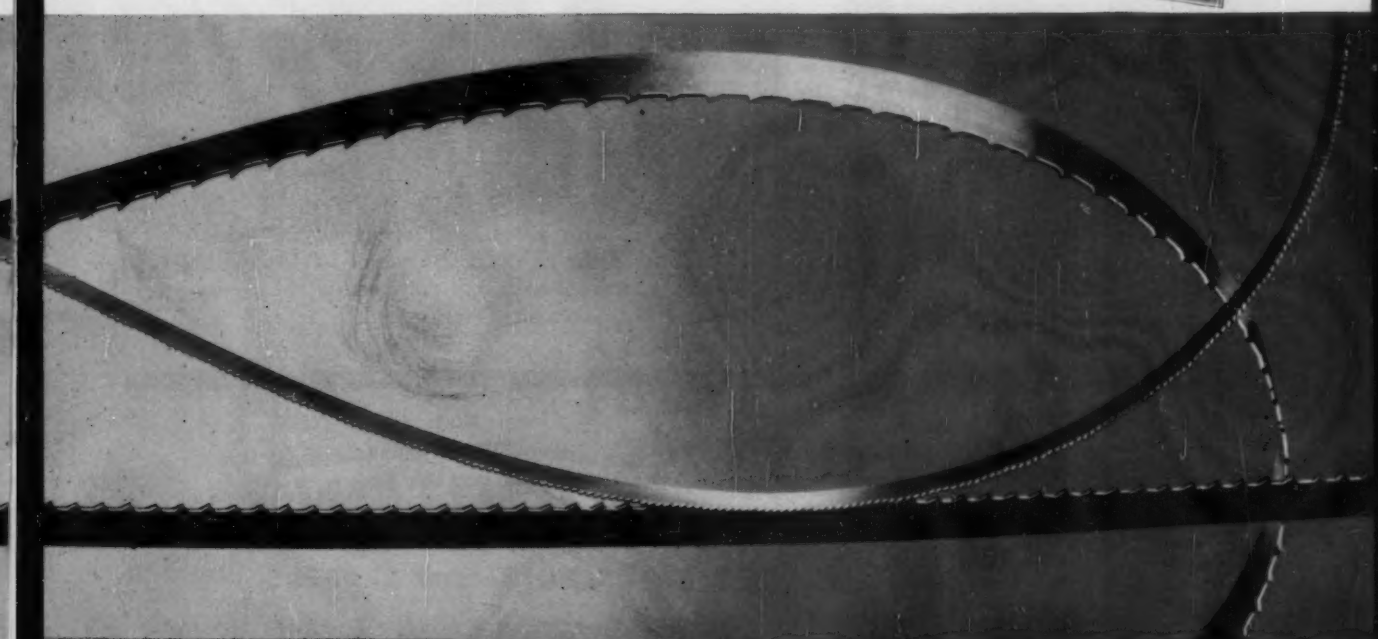
1. COMPLETE SELECTION Heller offers a full selection of "Job Tempered" Metal Cutting Band Saws. You can choose exactly the right tooth shape, set, and blade width in standard or high speed steel as required for your application.

2. CHARTS AND BOOKLETS FOR USERS Your Heller Distributor will furnish you with wall charts and booklets to help you choose the *right* Metal Cutting Band Saw for your applications. These visual aids will show you the speeds and feeds required for best cutting results, for contour cutting or cutoff work.

3. CONVENIENT PACKAGING Heller's packaging is designed for maximum user convenience. Blades come in bulk lengths of 100′ and 250′ coils so you can cut and weld the length you need when you need it. Or individually packaged blades are furnished cut and welded to fit all standard machines.

HERE ARE THE FACTS! Heller's new catalog of "Job Tempered" Metal Cutting Band Saws contains descriptions of all types of blades, tooth shapes, set, applications.

WRITE FOR YOUR COPY TODAY!



nucut

- Hand and Power Hack Saw Blades
- Flat Ground Die Steel
- Famous Heller Files

HACK SAW BLADES

FLAT GROUND DIE STEEL

FAMOUS HELLER FILES

Pay for Norton grinding machines while they build

Now you can buy or lease the most modern grinding or lapping equipment on convenient, economical terms

By replacing your obsolete grinding and/or lapping equipment with new Norton machines you can meet competition with the best production tools in the field.

You can now gain this competitive strength without risking financial weakness. Two Norton methods offer you logical, economical ways to modernize without jeopardizing your capital position — and without the need of borrowing or of raising money by any other means.

THE NORTON PURCHASE FINANCING PLAN

This Time Payment Plan enables purchase of new machines on extended terms. Simplicity is the keynote. Upon a down payment of 25% of the original purchase price, terms may be extended up to a maximum of five years, at an interest charge of 3¼% per year. Payments are equal and quarterly, starting 60 days after delivery. In the event that you wish to pay off the entire balance at any time, a discount approximately equal to the unearned interest will be allowed.

THE NORTON LEASE PROGRAM

This Program includes three tested plans for leasing new Norton grinding or lapping machines. Each plan offers you the option of terminating the lease or purchasing the equipment after a stated period. Particular advantages of the Lease Program are: (1) You can acquire needed machines for just the period in which you can use them profitably, thus eliminating the obsolescence factor; (2) You can make a thorough trial of equipment without going to the expense of actual purchase, unless you decide to do so later.

A Wide Choice of Machines

Norton machines available under the Purchase Financing Plan and Lease Program include a broad selection of the most popular types of grinders and lappers. Special arrangements will be considered whenever other Norton machines are required.

For Further Information

see your Norton Representative. He will be glad to discuss the relative merits of each Norton financing method, with regard to your particular requirements. He will also give you complete details of the various machines available and advise you as to which are best suited to your production needs. Or you can write direct. And remember: only Norton offers you such long experience in both grinding machines and grinding wheels to bring you the "Touch of Gold" that helps you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass.

To Economize, Modernize with **NEW**

NORTON

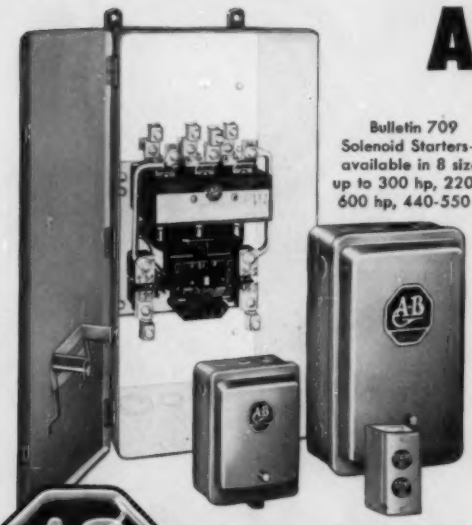
GRINDERS and LAPPERS

Making better products...to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels
Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives
Sharpening Stones • Behr-cat Tapes

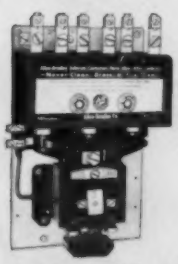
District Offices: Worcester • Hartford • Cleveland • Chicago • Detroit

"Our customers prefer ALLEN-BRADLEY"



Bulletin 709
Solenoid Starters—
available in 8 sizes
up to 300 hp, 220 v;
600 hp, 440-550 v.

A-B Quality



Bulletin 702
Solenoid Contactor
Size 3

Bulletin 702
Solenoid Contactor
Size 1

Bulletin 700
Solenoid Relay

Bulletin 800T
Oiltight Push Button

Bulletin 800T
Oiltight Selector Switch

Among leading manufacturers of machine tools, Allen-Bradley Quality motor starters are the favorite—as shown by many independent preference studies. Having the Allen-Bradley Quality trademark appear on your equipment means automatic customer acceptance.

The "simple design" of Allen-Bradley motor control . . . with only *one* moving part . . . guarantees reliable operation. The double break, silver alloy contacts—used in all Allen-Bradley controls—are always in perfect operating condition. Even inspection time—let alone maintenance time—is saved.

No matter what your control requirements may be, they can be met with standard components listed in the Allen-Bradley Handy Catalog . . . Allen-Bradley control specialists can help you with your control problems. *Standardize* on Allen-Bradley Quality motor control . . . add this sales asset to your production machines!

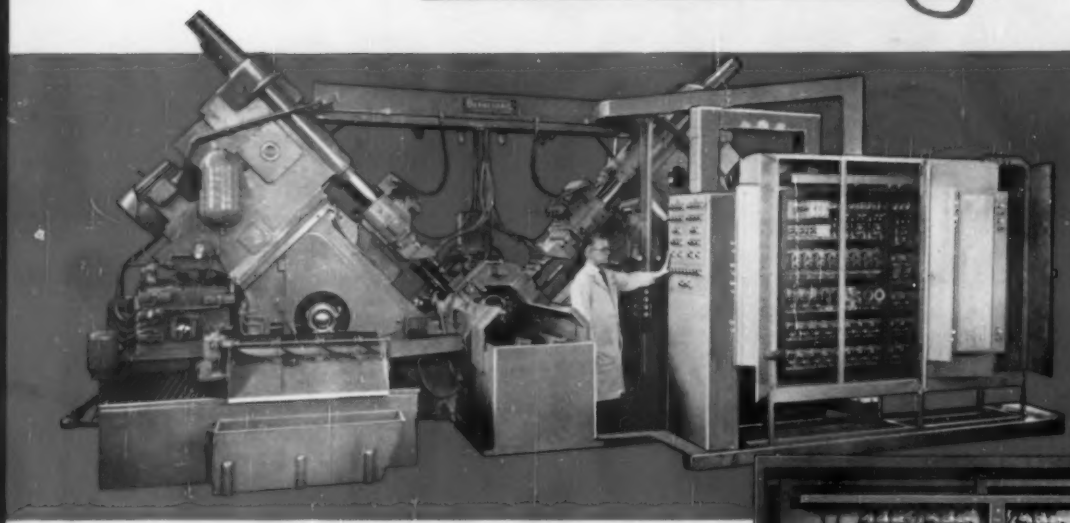
ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

5-57-R

for reliability... plus consistent operation

SPECIFY Allen-Bradley



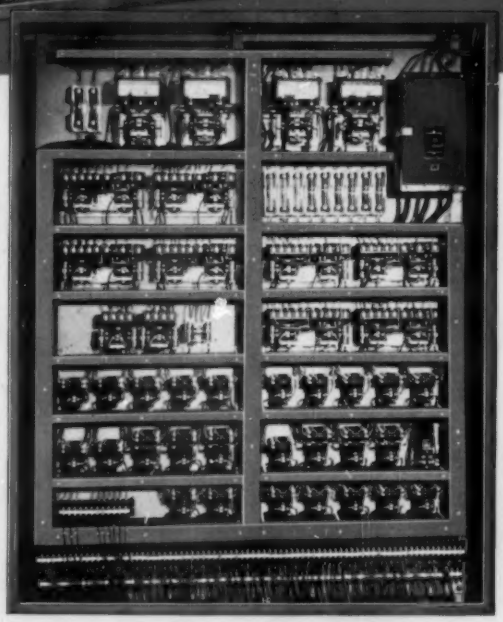
BARNESDRIL
Duplex type honing machine, for honing V-8 motor blocks, equipped with a special Allen-Bradley control panel.

The motor controls on your automatic machines must be reliable when the machines are new . . . and remain reliable when the machines are old. When the sequence of operations is short, the controls must be instantaneous and consistent in their operation . . . or production has to be slowed down to the maximum variation in time of contactor operation. Sluggishness of a single component . . . even for a split second . . . may mean costly repairs and work spoilage.

Reliability is an integral part of all A-B motor controls. The simple solenoid design . . . with only one moving part . . . assures millions of trouble free operations. The double break, silver alloy contacts never need service attention.

Let Allen-Bradley help you with your special control problems. As you know, "quality" and "cheap" are two "teams" never in the same league.

Please send for the new Allen-Bradley Handy Catalog.



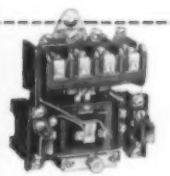
Motor control panel for a Barnesdril honing machine made from standard Allen-Bradley control units listed in the Allen-Bradley Handy Catalog.

5-57-R

A-B Quality

BULLETIN 849
"On-Delay"
Pneumatic Timer

BULLETIN 802T
Adjustable Lever
Oiltight Limit Switch



BULLETIN 709
Automatic
Solenoid Starter

BULLETIN 700
Universal Type
Solenoid Relay

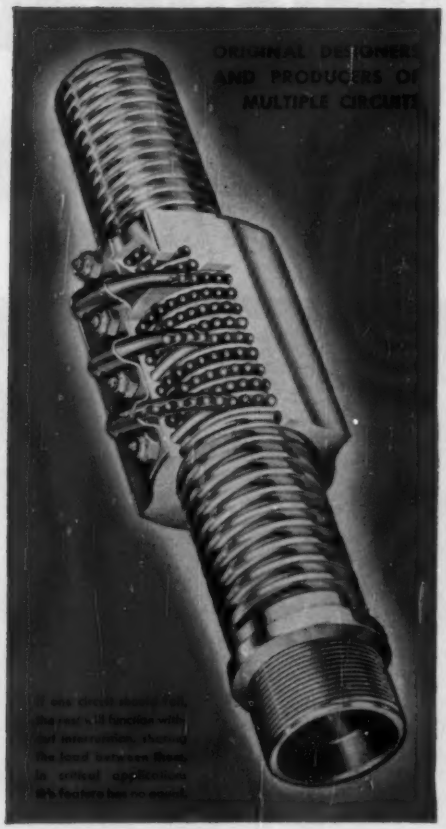
BULLETIN 800T
Oiltight Push Button
Station

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

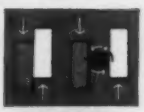
Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

SAGINAW b/b SCREWS are guaranteed 90% EFFICIENT!

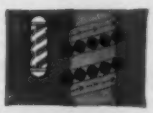
Require 4/5 LESS torque than Acme Screws for same linear output on Actuator and Positioner Applications! Saves space, weight!



WHAT IT IS AND HOW IT WORKS

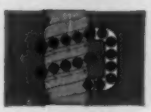


Let's start at the beginning, with the familiar principle that there's far less friction in *rolling* than in *sliding*. By applying this principle,



Like stripes on a barber pole, the balls travel toward end of nut through spiral "tunnel" formed by concave threads in both screw and mating nut.

the *Saginaw ball/bearing Screw* radically increases the efficiency of rotary-to-linear motion (and vice versa). Instead of *sliding*, mating surfaces *glide* on rolling steel balls.



At end of trip, one or more tubular guides lead balls diagonally back across outside of nut to starting point, forming closed circuit through which balls recirculate.

SIX DESIGN ADVANTAGES

1. Vital Power Savings. Permit much smaller motors with far less drain on electrical system, simpler circuitry.

2. Space/Weight Savings. Screws themselves are smaller, lighter; permit smaller motors and gear boxes; eliminate auxiliary equipment required by hydraulics.

3. Precise Positioning. Machine-ground type will position components far more precisely than hydraulics or pneumatics; tolerances on position are held within .0006 in./ft. of travel.

4. Temperature Tolerance. Normal operating range from —75° to +275° F.; in selected materials, will function efficiently as high as +900° F.

5. Lubrication Latitude. If lube fails, will still function with remarkable efficiency. Units have been built and qualified for operation without lubrication.

6. Fail-Safe Performance. Far less vulnerable than hydraulics; Gothic-arch grooves, yoke deflectors and multiple circuits provide added assurance against failure.

SAGINAW b/b SPLINE

Utilizing the same basic *gliding ball* principle, Saginaw has developed the *Saginaw b/b Spline* which radically increases the efficiency of transmitting or restraining high torque loads.

Averages 40 times lower friction coefficient than sliding splines!

It can be fitted with integral gears, clutch dogs, bearing and sprocket seats, etc., for use with a wide variety of electrical units. Units have been built from 3 inches to 10 feet long—⅜ to 6 inches in diameter.

Available in custom machine-ground and stock rolled-thread types. Units have been built from 1½ inches to 39½ feet long—⅜ to 10 inches in diameter.

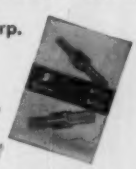
Saginaw ball bearing Screws & Splines

SAGINAW STEERING GEAR DIV., GENERAL MOTORS CORP., SAGINAW, MICH.

SEND COUPON FOR NEW 1957 ENGINEERING DATA BOOK

or see our section in Sweet's Product Design File

Saginaw Steering Gear Division, General Motors Corp.
b/b Screw and Spline Operation
Dept. 6R, Saginaw, Michigan



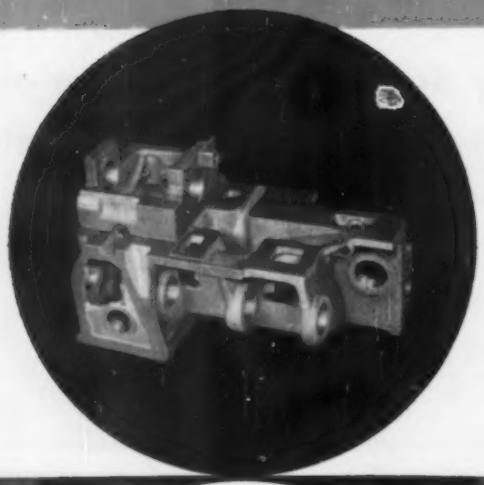
Please send new engineering data book on Saginaw b/b Screws and Splines to:

NAME_____

COMPANY_____ TITLE_____

ADDRESS_____

CITY_____ ZONE____ STATE_____



At Brown & Sharpe

Natcos Help From

At Brown & Sharpe, a 22-spindle Natco 3-way Machine handles finished drilling, boring and reaming on "00" screw machine beds

NATCO

Slash In-Process Time 16 Weeks to One Week

On Automatic Screw Machine Beds

Even on precise machine tool parts, traditionally handled on a "job-shop" basis, Brown & Sharpe gained great advantage by installing an automatic line. Prominent in the line are two Natcos, engineered and tooled to handle all drilling, boring and reaming on either the No. 00 or No. 2 automatic screw machine beds.

One Natco does all roughing—the second handles finishing. Total of 62 operations. Each Natco is tooled to process two parts at once—tooling is interchangeable to accommodate either sized bed.

Extreme machine tool accuracy must be maintained throughout. In one operation the Natco drills through five walls, holding centers parallel to the locating surface within .0015" for the full 42" distance. In another case, Natco engineering devised a tooling leaf that automatically drops through a core in the part, providing internal boring bar support.

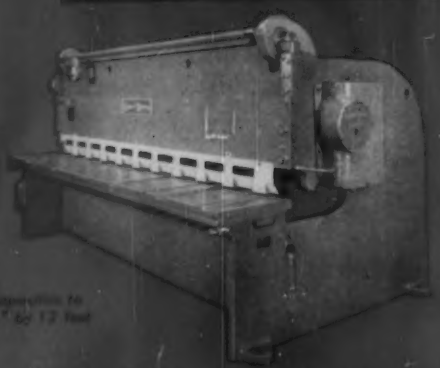
Natcos make sense even on "job-shop" jobs. Call in a Natco Field Engineer—he can quickly tell you whether a Natco can be a cost-saver on your next job.

National Automatic Tool Company, Inc.

Richmond, Indiana *Multi-spindle drilling, boring, and tapping machines. Special machines for automatic production.*

Call Natco Offices in Chicago, Detroit, New York, Buffalo, Boston, Philadelphia, Cleveland, Los Angeles; distributors in other cities.

how to produce less for the scrap heap



Check your scrap "production." A certain amount of scrap is to be expected. But, if your scrap heap is growing out of bounds chances are, your shear is a contributor.

Even a skilled operator is at the mercy of a "cranky," inaccurate shear. Put the same operator on a Lodge & Shipley Shear with "built-in" accuracy and watch production flow. Lodge & Shipley Power Squaring Shears are proved for accurate shearing . . . produce for less for the scrap heap and for more for production.

For details, request New Condensed Catalog PS-13. Write: The Lodge & Shipley Co., 3056 Colerain Ave., Cincinnati 25, Ohio

your LODGE-ical choice . . .

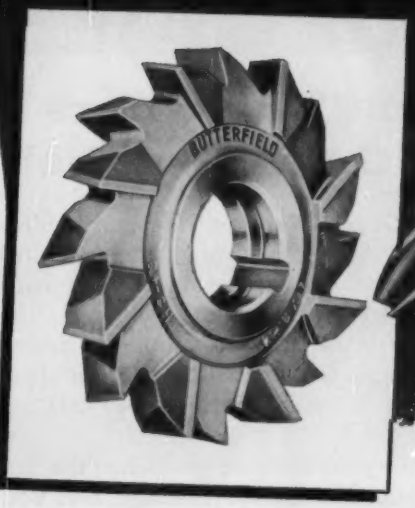
Lodge & Shipley

100%

BUTTERFIELD

Cutters and End Mills

. . . high speed steel or carbide . . .



100% COMPLETE LINE . . . EVERY TOOL 100% INSPECTED . . . AND YOU GET

100% SERVICE FROM YOUR BUTTERFIELD DISTRIBUTOR

Butterfield also offers a complete line of taps, dies, drills, reamers, hobs and carbide cutting tools. There are Butterfield warehouses in Chicago, Cleveland, Detroit, Fort Worth, Los Angeles, New York, San Francisco. **BUTTERFIELD DIVISION** • Union Twist Drill Company • **Derby Line, Vermont.**

"Special" fasteners getting out of hand? CHICAGO can help you standardize

Any time you eliminate a "special" fastener you're saving important money. CHICAGO engineers have helped many firms cut costs by designing for *standard* fasteners . . . probably we can do the same for you.

The CHICAGO line is surprisingly complete—more than 4,000 standard products always in stock. So there's a good chance that we make anything you're likely to need in an industrial fastener.

For help with all your fastener problems, the man to see is your CHICAGO distributor. Through him you get the full benefit of our 85 years experience . . . exclusively in fasteners.

THE CHICAGO SCREW COMPANY

DIVISION OF STANDARD SCREW COMPANY • ESTABLISHED 1872
2505 WASHINGTON BOULEVARD, BELLWOOD, ILLINOIS

12 spindle speeds, instantly selected with direct-reading, color match dial.

All-geared spindle drive transmission.

Totally enclosed quick change gear box. 48 or 54 thread-feed changes.

Ground and flame hardened bedways insure years of accurate service.

Hardened steel gears in all 3 transmissions assure long-life operation.

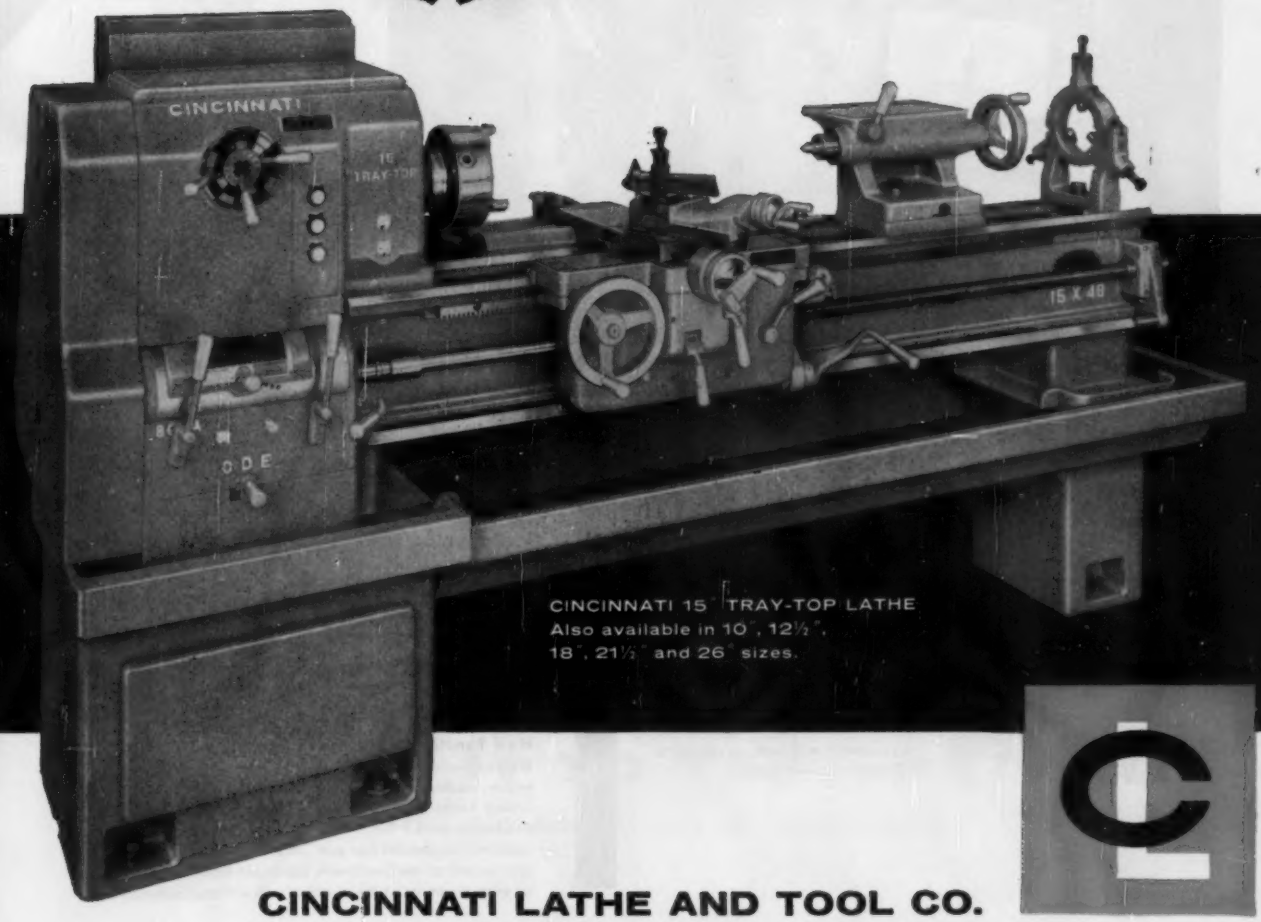
Fully enclosed electrical controls increase operating ease and safety.

Tray-Top Lathes give you many other features normally found only on larger, more expensive lathes. For all the facts and features, see your Cincinnati dealer. Send today for catalog data.

Because it's a

CINCINNATI
TRAY-TOP LATHE

more goes into it...
you get more out of it!



CINCINNATI 15" TRAY-TOP LATHE
Also available in 10", 12½",
18", 21½" and 26" sizes.

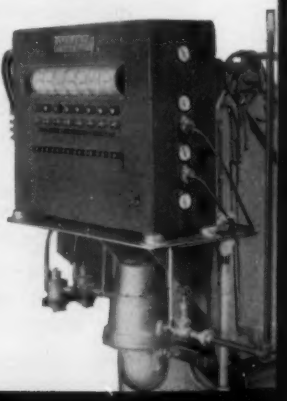
CINCINNATI LATHE AND TOOL CO.

3207 Disney Street, Cincinnati 9, Ohio

Builders of Engine, Toolroom and Fixed Gap Bed Lathes and a Complete Line of Drilling Machines

T-P Ingenuity Puts Profit Into Automatic Gaging and Sorting . . . Taft-Peirce Air-Electric Gaging has resulted in a variety of automatic gaging and sorting machine installations. Individual parts are air gaged for size, then dropped into bins marked with size categories. T-P creative engineering makes mass inspection and sorting of parts a profitable reality in your plant.

Taft-Peirce Gaging Stations bring rugged performance plus tight tolerance control to transfer lines . . . T-P equipment handles a multitude of dimensions on a day-in day-out basis, repeating readings without fail. There's one right answer to every automatic or semi-automatic gaging application, so take advantage of specific experience in this specialized field . . . take your problem to the Taft-Peirce Instrument Gage Division.

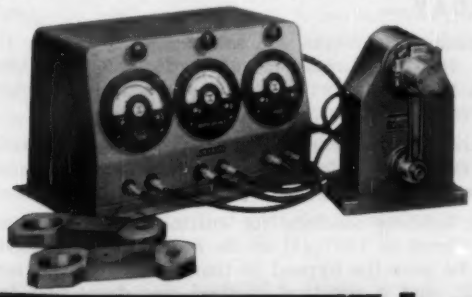


New Versachek Electronic Comparator laboratory accuracy at minimum cost . . . Taft-Peirce provides application versatility plus laboratory precision, priced to appeal to every shop large or small. Four switch-selected graduations: .0005", .0001", .00005", .00001" — all on one dial. Calibration is simple, with 100% linearity over entire scale. Use a Versachek to police wear on shop working gages, for size control beside the machine, or use special output jack with oscilloscopes, ink recorders, and other inspection devices.

New Packaged Control Center For Simplified Feedback Gaging . . . Here's in-process quality control with minimum investment in equipment. Buy this air-electric control unit from stock and apply it to on-the-machine inspection. All accessory fixturing is available from one source — Taft-Peirce — plus whatever application help you need. Use for size control with pass or reject indicated by pilot lights.

New Functional Styling For T-P CompAIRator Air Gages . . . Special slanted face has glare-reducing visor for easier reading under all lighting conditions. Zero and range setting knobs are within easy reach of the inspector. Plus production-tested T-P Velocity-Venturi Air Circuit for exceptional dependability and accuracy. Use the CompAIRator to sort at the bench with instrument-mounted plug, ring, or snap gage, or at the machine with air hose extension.

Now! Pass or Reject Parts having related dimensions by one computed reading on one dial . . . Patented Taft-Peirce CompUtair streamlines jobs requiring: (1) check of taper between two diameters, (2) alignment or concentricity of two diameters, (3) squareness of bore to face, (4) center distance without respect to hole size, (5) bend or twist developed during machining. Pass or reject a number of product dimensions simultaneously with one composite reading on one dial. You can't beat the CompUtair for speed and economy on any long-run job.



Look what TAFT-PEIRCE is Doing with INSTRUMENT GAGING

New, Electronic Versachek plus redesigned CompAIRator bring wide versatility, extreme accuracy to quality control.

Like to find new ways to do things? Cut corners? Shave costs? Help your company build a better product?

There's almost always a new way to do it with Taft-Peirce Air Gaging! Engineers are continually finding more opportunities to streamline inspection and quality control with Taft-Peirce Instrument Gaging.

Take advantage of all the "tricks to the trade" in gaging. Consult Taft-Peirce for the most advanced, lowest-cost solutions to your problems.

Get all the Facts . . . from your nearest Taft-Peirce representative or write for Air Gage Bulletin No. 613.

TAKE IT TO TAFT-PEIRCE

THE TAFT-PEIRCE MANUFACTURING CO., WOONSOCKET, R. I.

T-P Means TOP Precision

We've come a long way in...

Grant's "Gear Book for 1893".

YESTERDAY—

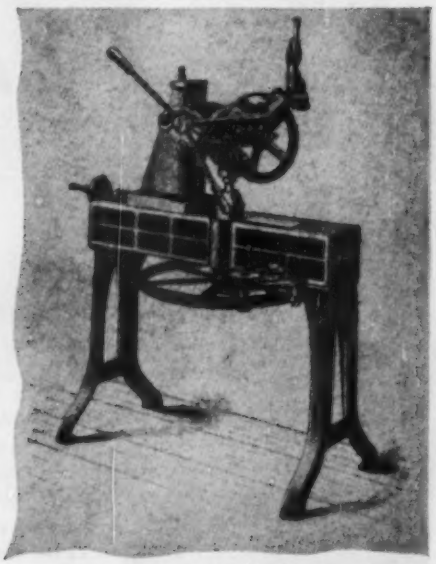
Philadelphia Gear Works was established by George B. Grant in 1892 for furnishing cut tooth gears at a time that cast tooth, or mortise gears with inserted wooden teeth, were used for transmitting power.

The contribution made by George B. Grant to the American gear cutting industry was considerable. He pioneered many gear firms in this country, some still in existence.

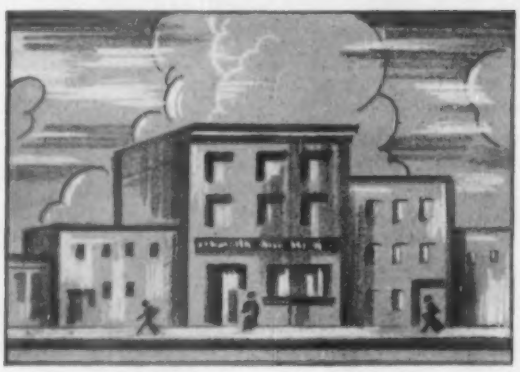
The first hobbing machine for cutting spur gears was built by Grant in 1887 (U. S. A. Patent No. 405,030). In 1899, he gave the hypoid its name though it was not until 1925 that a practical method was developed for producing these gears.

Grant contributed greatly to the development of the involute tooth by championing as early as 1885 the use of the involute form, at a time when there was much controversy over the involute versus epicycloidal tooth.

Grant invented an Odontograph and published Grant's Treatise on Gears which for many years has been the gearing text in use by colleges and engineers.



Machine built by Grant for cutting bevel gears in 1893.



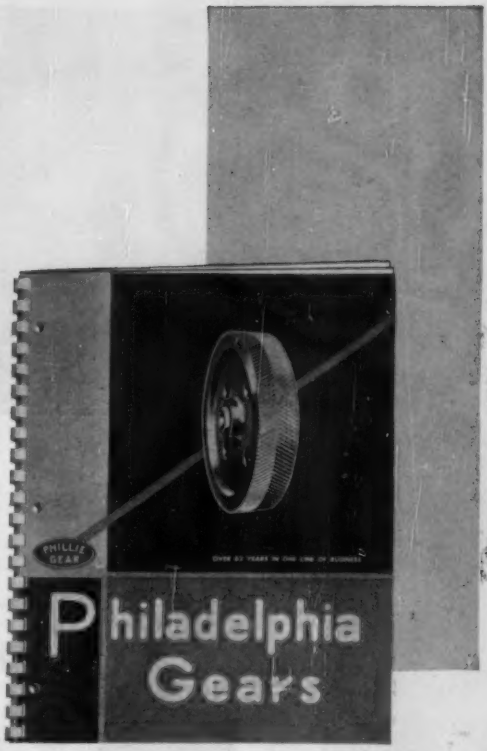
The original plant occupied by Philadelphia Gear Works at 125 S. 11th St., Philadelphia.

phillie gear®

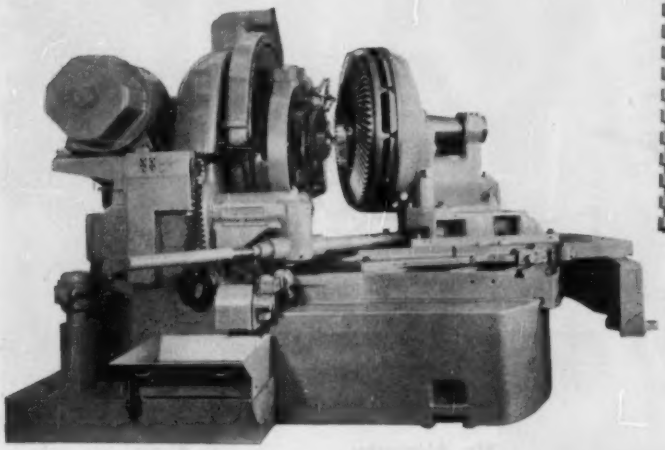
....65 YEARS
OF GEAR MAKING

TODAY—

Philadelphia Gears are made to the highest standards of engineering skill and exactitude. They are the culmination of over 65 years' specialized experience in the manufacture of gears. Our shops are equipped with the latest gear making machines, many of which incorporate exclusive design features. Today our gear manufacturing facilities are among the largest and best equipped in the country. Our competent engineering staff, expert craftsmen and modern quality control facilities assure you of advanced gear design service and consistently better gears with longer life.



—it's practically a "treatise" on gears— Never before has so much helpful information been assembled between the covers of a gear catalog . . . 72 pages of illustrations, diagrams, definitions, tables, charts, and explanations regarding all types of gears. Write on your business letterhead for your copy.



New No. 70 Spiral Bevel Generator designed to cut large spiral bevel gears up to 72" diameter, 10" face widths.

PHILADELPHIA PLANT No. 1

PHILADELPHIA PLANT No. 2

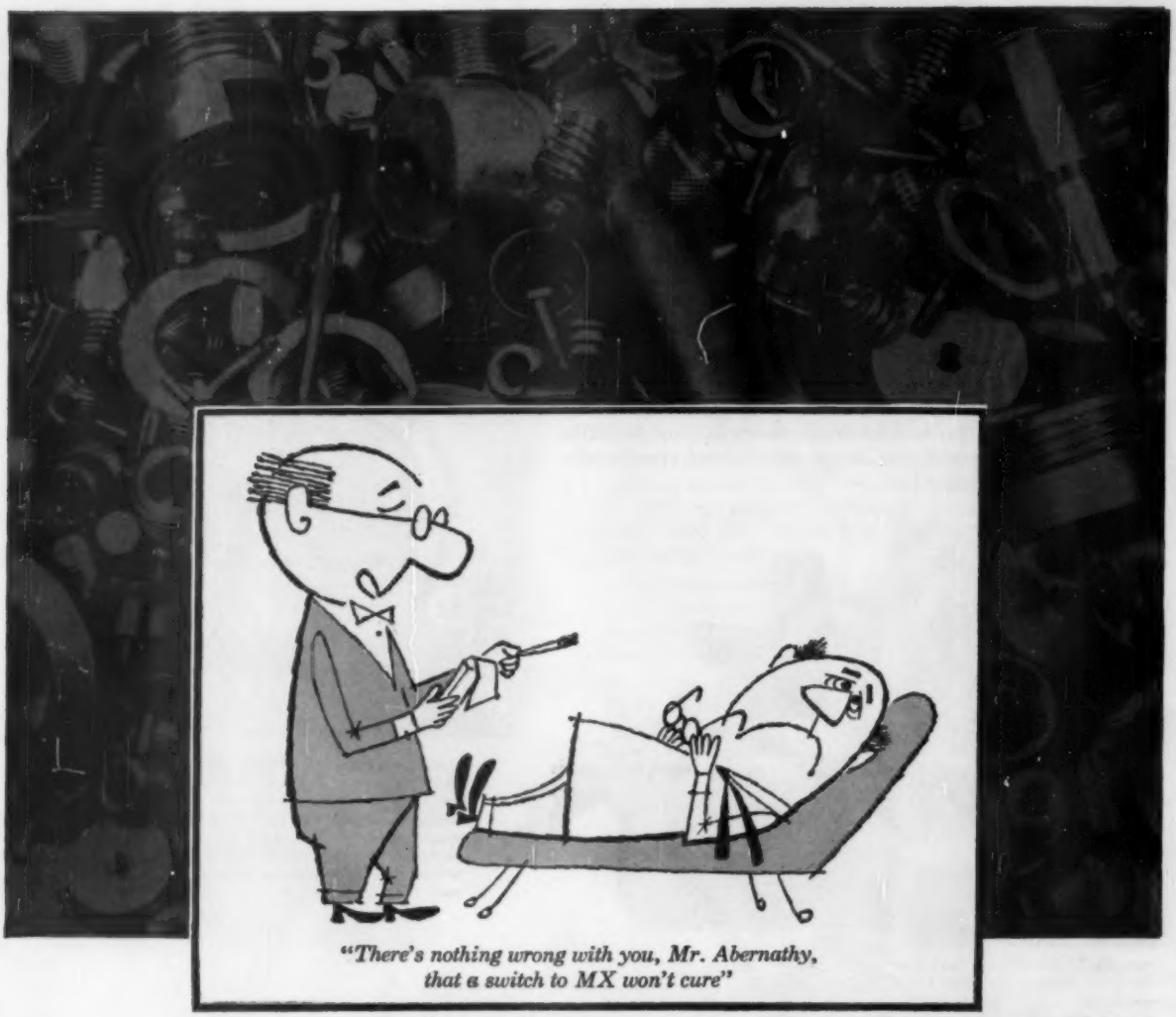
VIRGINIA PLANT

PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. & G STREET, PHILADELPHIA 34, PENNA.
Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS

Virginia Gear & Machine Corp. • Lynchburg, Va.



"There's nothing wrong with you, Mr. Abernathy, that a switch to MX won't cure"

Are you suffering from high production costs? Low tool life? A rise in rejects? Or a falling off in finish? USS MX Free-Machining Steel offers a sure cure for these depressing conditions.

With this faster-cutting bar stock you not only can produce more parts per hour but you'll turn out *better* parts. Better in finish, more accurate in dimension, lower in cost. Tool life will be longer. You'll have fewer rejects to cut into your profits. It's been proved in shops where USS MX has been put to work.

Such highly desirable results are obtained with MX Steel primarily because of its superior machinability. Also because this steel is consistently uniform in shipment after shipment. Uniform in cutting characteristics. Uniform in its composition. Uniform in freedom from injurious imperfections.

USS MX Steel works *with* your tools, not against them. That's why, on many jobs, tools have lasted up to 200% longer, cutting speeds have increased as much as 50%, output has been boosted an average of 40%. And remember, with all these advantages, *MX Steel costs no more than ordinary screw stock.*

Available in both Bessemer and Open Hearth grades, USS MX Free-Machining Steel is produced in all the popular screw stock sizes. It is sold in cold-finished form by your regular supplier, under either our trademark "MX" or his own identifying mark. In hot-rolled form, MX Steel is available through our nearest sales office.

UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Bigger output . . . longer tool life . . . lower costs

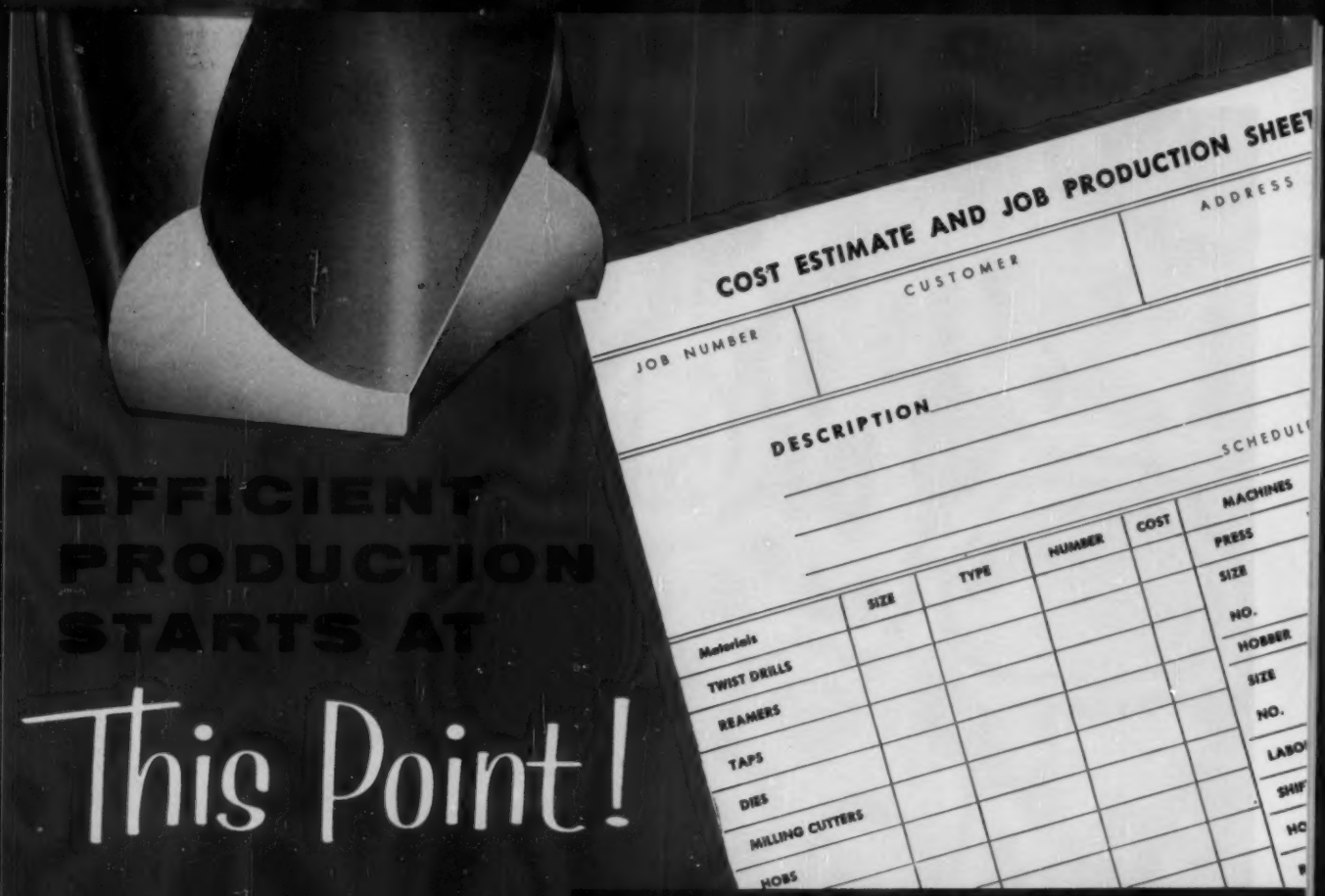
—when you do the job with free-machining

MX

Registered trademark

USS

UNITED STATES STEEL



EFFICIENT PRODUCTION STARTS AT This Point!

Profits build up when this point "takes hold" *fast!*

Why? Obviously the only function of a Twist Drill is to make holes. And the faster it makes them—with no "time out" for re-sharpening—the more you can make *from them.*

So say "Standard" and get *more* holes for your money . . . *many more!*

Quality Tools Since 1881

Complete line stocked by the Standard Tool Distributor in your area

STANDARD TOOL CO.

3930 CHESTER AVENUE CLEVELAND 14, OHIO

FACTORY BRANCHES IN NEW YORK • DETROIT • CHICAGO • DALLAS • SAN FRANCISCO

THE STANDARD LINE: *Twist Drills · Reamers · Taps · Dies · Milling Cutters · End Mills · Hobs · Counterbores · Carbide Tools · Gages*

Gulf Super-Quench possesses remarkable service stability—One reason why it's the high-speed quenching oil used by Lindberg for the past ten years.

Batch elevator type atmosphere furnace used by Lindberg for clean neutral hardening, gas carburizing and carbo-nitriding. Super-Quench is a "must" on low carbon stampings and screw machine parts.

why GULF fast quenching oil

Here's why in the words of Norman O. Kates, Chief Metallurgist of Lindberg: "We appreciate Super-Quench's versatility to effectively harden parts of varying cross sections made of low hardenability steels. A 12,000 gallon central storage system pumps Super-Quench to various tanks throughout the plant. Diverse products such as production stampings, shafts, gears, jigs and fixtures are quenched to uniform hardness with minimum distortion."

Here Super-Quench effectively hardens pieces of low hardenability steel with a minimum of distortion.
Tom Corcoran, Lindberg Plant Superintendent, and V. O. Chase, Gulf Sales Engineer, inspect extension sockets coming out of Super-Quench, after going through a continuous atmosphere controlled furnace.

SUPER-QUENCH is the used by Lindberg Steel Treating Company

Melrose Park, Ill.

Super-Quench offers you higher initial quenching speed than conventional quenching oils. It achieves deeper, more uniform hardening of many types of steel and produces less distortion in pieces of varied sections and shapes.

Look into *all* the advantages of Gulf Super-Quench. Contact your nearest Gulf office and ask for a Gulf Sales Engineer to call. Or send the coupon for free booklet.

GULF OIL CORPORATION AM
1822 Gulf Building, Pittsburgh 30, Pa.
Please send me, without obligation, a copy of your 24-page booklet on the uses and advantages of Gulf Super-Quench.

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

GULF

THE FINEST PETROLEUM PRODUCTS FOR ALL YOUR NEEDS

MEMORANDUM
FROM ENGINEERING DEPARTMENT
12/12/56
Design Group
Att.: C. D. Smith
Vibrating Conveyor #3 broke down after approximately
17,000,000 cycles of operation. Spring return lever
failed, due to low fatigue resistance. Flexloc locknuts
worn, but still locked in original positions.
Recommendations:
1) Redesign lever to give increased strength in
center section.
2) Eliminate side play in lever motion which has
been causing excessive wear in related parts.
3) Continue use of Flexloc locknuts.
B.F.W.

Why designers specify FLEXLOC self-locking nuts

Where products must be tough . . . must stand up under vibration, shock and abuse . . . designers specify rugged, reliable, precision-built FLEXLOC self-locking nuts as fasteners.

HERE'S WHY:
FLEXLOC locknuts are strong: tensile strengths far exceed accepted standards. They are uniform: carefully manufactured to assure accurate, lasting spring tension in the flexible locking collars. And they are reusable: rough screw threads, repeated removal and replacement, frequent adjustments will not affect their locking life.

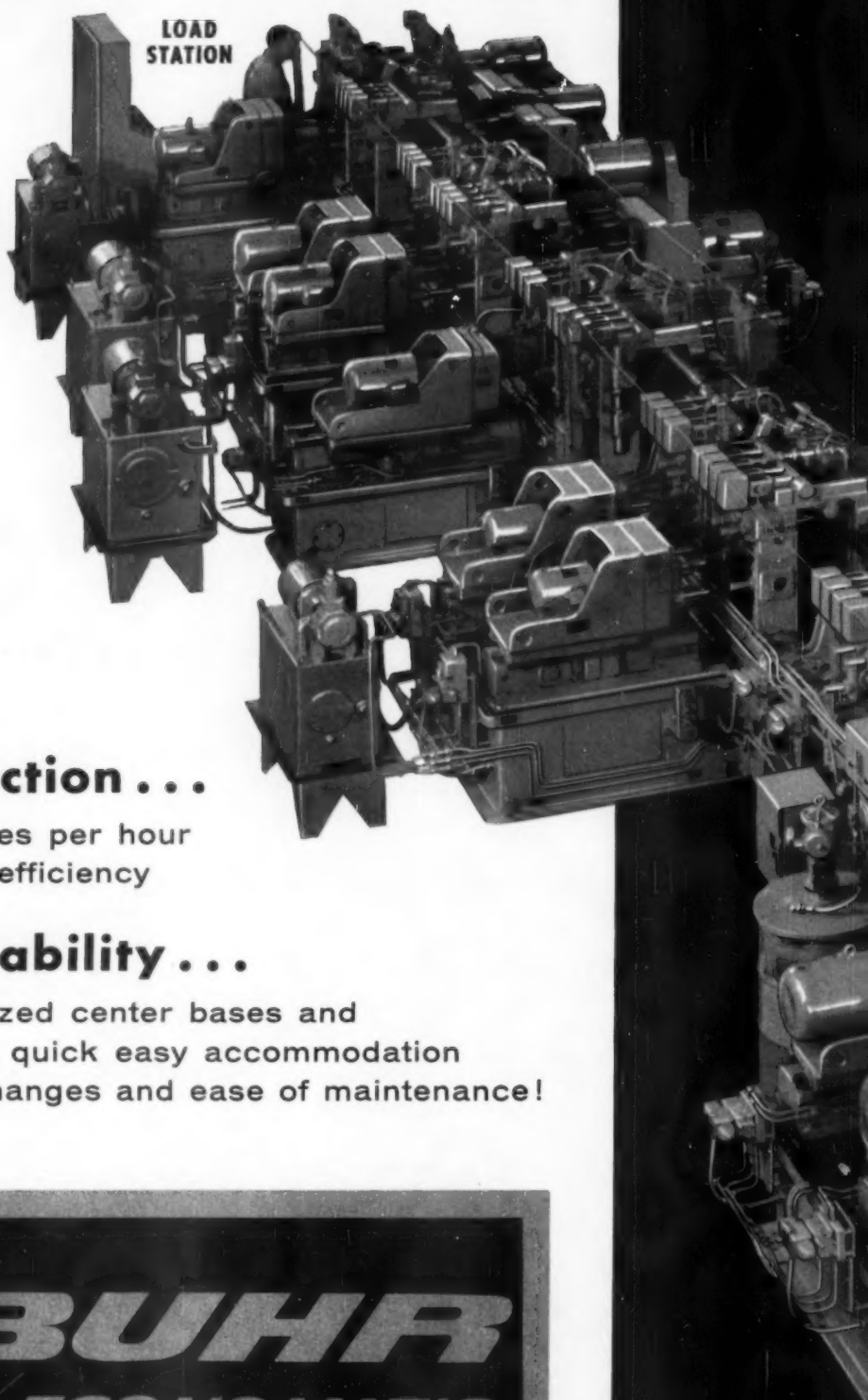
Standard FLEXLOC self-locking locknuts are available in a wide range of standard sizes and materials, to meet the most critical locknut requirements. Your authorized industrial distributor stocks them. Write us for complete catalog and technical data. Flexloc Locknut Division, STANDARD PRESSED STEEL CO., Jenkintown 1, Pa.

STANDARD PRESSED STEEL CO.

FLEXLOC® LOCKNUT DIVISION

SPS
JENKINTOWN PENNSYLVANIA

sets
precedent in
production
adaptability



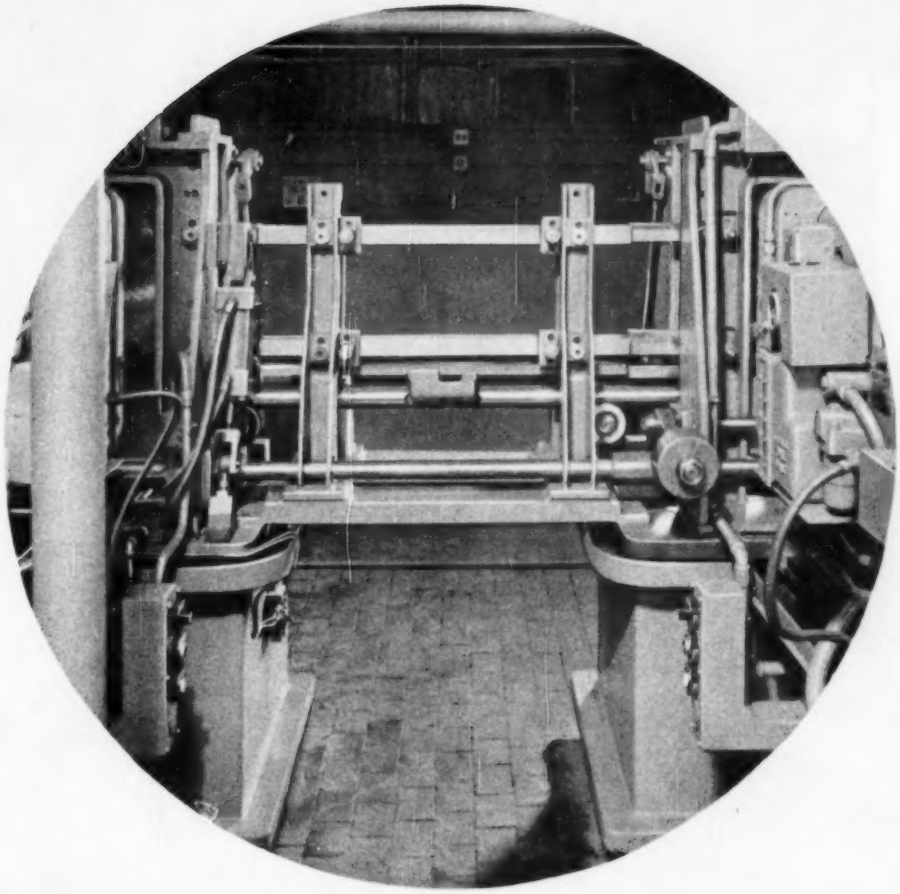
production . . .

100 pieces per hour
at **100%** efficiency

adaptability . . .

sectionalized center bases and
wings for quick easy accommodation
of part-changes and ease of maintenance!

BUHR
ECONOMATIC



BUHR ECONOMATIC

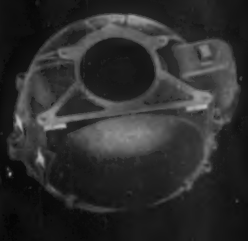
setting the pace in production adaptability

by clean sectionalization in

ECONOMATION

"ECONOmical autoMATION"

part—torque converter housing



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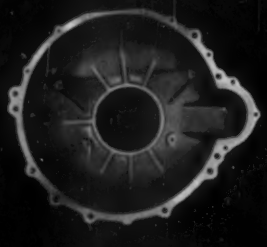

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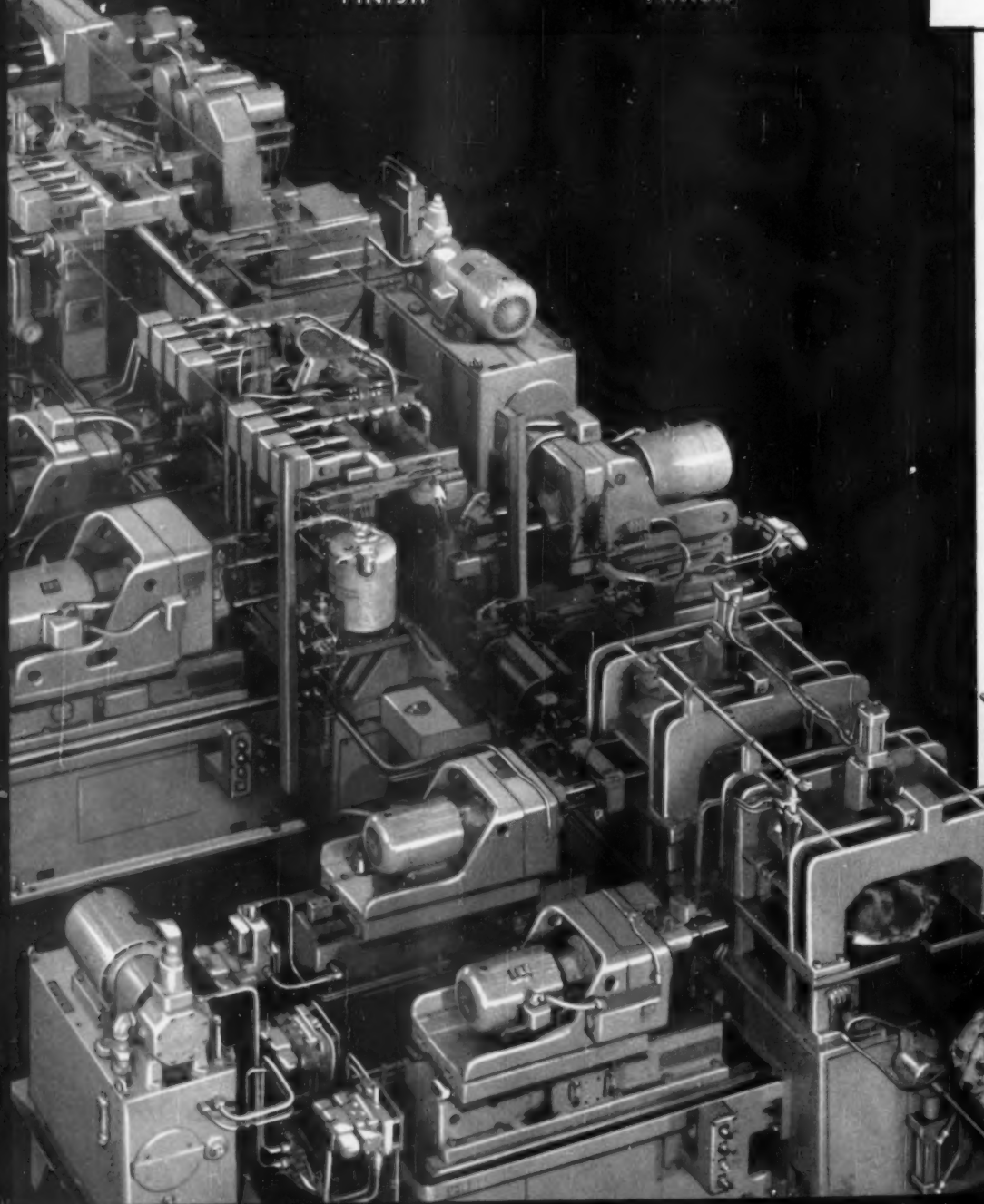


performs 90
each on two
converter ho
27 drilling, 1
17 tapping,
3 rough-bori
3 precision-
3 precision-
and 15 prob

ms 90 operations
on two different
rter housings . . .
ling, 15 chamfering,
ping, 3 milling,
h-boring,
ision-boring,
ision-gauging
5 probing

pace-setting features

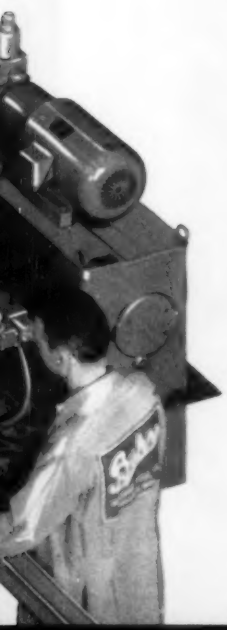
ADAPTABILITY . . . Buhr pioneered interchangeability of bases and parts, plus the clean design to provide ample areas between stations (as may be noted in photo at left). This means 3-way economy—easier adaptation to part-changes, easier maintenance and less down-time.

INTERMITTENCY . . . takes either of two housings with uncommon hole-locations and processes them intermittently!

BI-METAL ACCOMMODATION . . . each spindle-head is equipped with change-gear boxes for accommodating either cast iron or aluminum parts!

standard features

- automatic lubrication of all moving parts
- mist-lubrication to all spindles to maintain uniform temperature in heads
- all spindles arranged for pre-setting of cutting tools to minimize downtime for tool changes
- hardened-and-ground automatically-lubricated steel ways
- standard and special parts interchangeable for ease of maintenance
- J.I.C. Standards throughout



BUHR MACHINE TOOL CO.®

ANN ARBOR, MICHIGAN

Solidly Engineered • Precision Built • for World's Leading Manufacturers

You have to move fast

to get the jump on today's expanding market

Industrial companies are spending more than $5½ million every twenty minutes for needed goods and services. In spending that much money, they move mighty fast. But *you* have to be even faster to sell to today's dynamic industrial market. Especially if you want to thoroughly cover your customers and prospects among the thousands of industrial companies that are spending this vast sum.

A sound, well-balanced advertising program can help your sales force make an immediate impact on this big market—the market that won't wait to be sold, because it can't wait to buy.

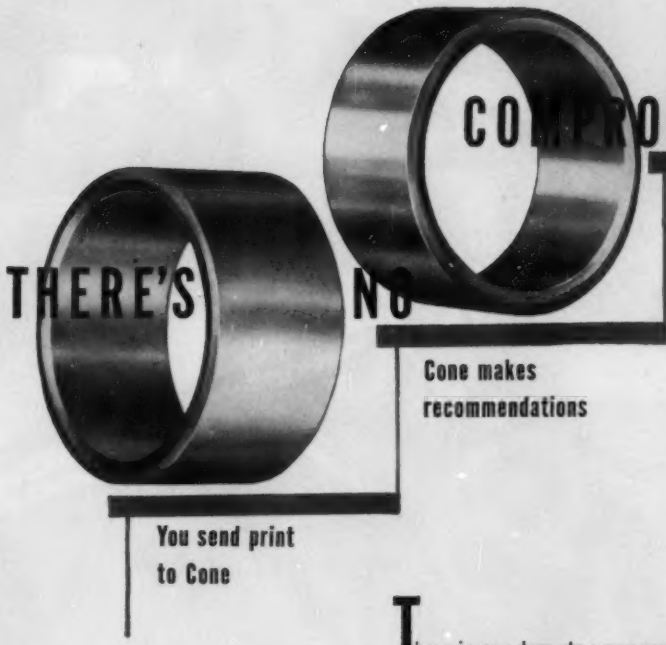
To keep ahead of this expanding market, put hard-hitting industrial advertising on the job. It will give you a greater return on your sales investment.

NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION, INC.

271 Madison Avenue, New York 16, N. Y.

An organization of over 4000 members engaged in the advertising and marketing of industrial products, with local chapters in ALBANY, BALTIMORE, BOSTON, BUFFALO, CHICAGO, CLEVELAND, COLUMBUS, DALLAS-FORT WORTH, DENVER, DETROIT, HAMILTON, ONT., HARTFORD, HOUSTON, INDIANAPOLIS, LOS ANGELES, MILWAUKEE, MINNEAPOLIS-ST. PAUL, MONTREAL, QUE., NEWARK, NEW YORK, PHILADELPHIA, PITTSBURGH, PORTLAND, ROCHESTER, ROCKFORD, ST. LOUIS, SAN FRANCISCO, TORONTO, ONT., YOUNGSTOWN.

No. 6 in a series


THERE'S NO COMPROMISE
You get demonstration of your work and complete job development record
Cone submits samples of your work
Cone makes recommendations
You send print to Cone

There is no adequate compromise with efficient production practices, if you are in business for a profit.

But you don't always know just how competitively efficient your equipment is. Case histories of what the other fellow is doing are sometimes garbled. At least the poor ones are not advertised. And conditions vary in all plants. Sometimes you have reason to be more concerned with what you don't want in new equipment than with what you do want. Cone believes too much is at stake for a machine to go into a line unequipped for the job, with either carbide or hss tools.

The Conomatic Carbide Development treats each job individually from standpoint of work, machine, tools, and operating personnel.

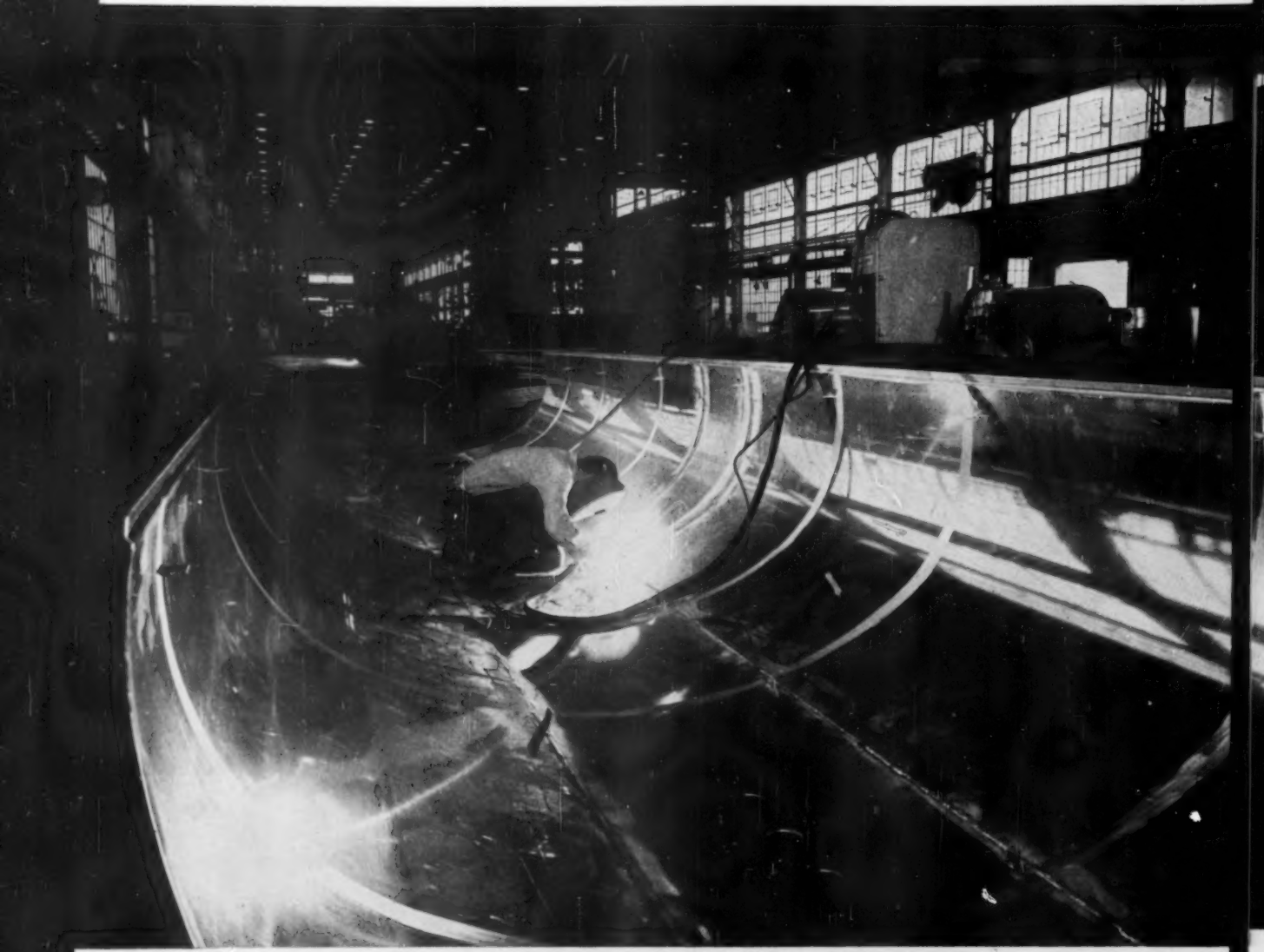
DATA FOR COMPARISON

Part.....Bushing	Length.....⅝"
Machine.....1⅝" Conomatic	Hole Dia.....1¼"
Tools.....100% Carbide Tipped	RPM.....825
Material.....8620	Time.....14.8 Secs.
Stock Size.....1⅝"	

Conomatic

For particulars send for "Four Steps With Cone"

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.



Transport tank begins to take shape, as butt joints are welded to form outer shell. Heil Company is one of the top producers of aluminum transport tanks.

Switch to Fillerarc* equipment boosts

PRODUCTION RISE ATTRIBUTED TO FASTER WELDING, FEWER REJECTS

Building aluminum transport tanks that must withstand pressures of 34,000 pounds per square inch requires welds that are near-perfect . . . leakproof.

At the Heil Company, Milwaukee, Wisconsin strict tests show that more tanks welded with General Electric automatic and semi-automatic welders are leak-free than those welded with any other equipment they have used or tested.

Rejects have been cut so much since the switchover to General Electric Fillerarc equipment that production has jumped 35%.

Increased speed of welding is also helping to boost production at Heil. The automatic current regulation and constant arc length features of the equipment enable weldors to set the generators once and then forget about them . . . even if they change wire speed in the middle of a job. *Reg. trademark of General Electric

This saves the time previously spent crawling in and out of the tank bodies to change settings.

WIRE PULLING FEATURE REDUCES JAMMING

Weldors are enthusiastic over the fact that the Fillerarc gun pulls the wire to the work instead of pushing it. Using fine $\frac{1}{16}$" aluminum wire, Heil had experienced considerable kinking with previous equipment. According to Harold Woda, weldor-fitter, "We couldn't weld an hour straight without it jamming up. Now, using the Fillerarc gun, the wire never jams," he says.

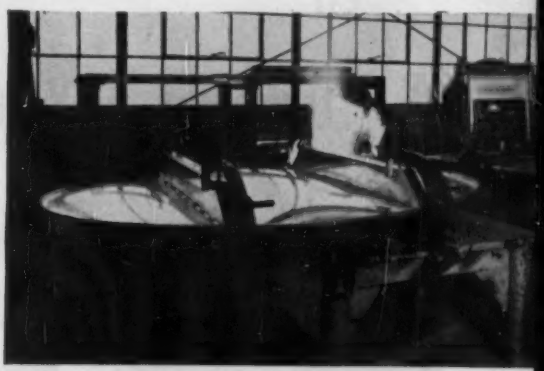
Bill Dyble, supervisor of welding engineering and research for Heil, is pleased with the constant arc length feature of Fillerarc welders. "Constant arc voltage prevents burnback," he says. "Before switching to Fillerarc welders some of our operators spent as much as two hours a day overhauling their torches."

GENERAL ELECTRIC

FIRST STEP IN TANK PRODUCTION is joining sheets of 5/32" thick aluminum alloy, type 5154. Automatic Fillerarc welding is used here. Inset shows sample of weld obtained.

COMPARTMENT SECTIONS SECURED with semi-automatic Fillerarc welders. Wire drive, argon gas cylinder are on cart for easy portability.

WELDOR ADJUSTS WIRE SPEED with remote-control unit . . . no need to crawl out of tank. Automatic current and arc-length features of equipment take care of the rest.



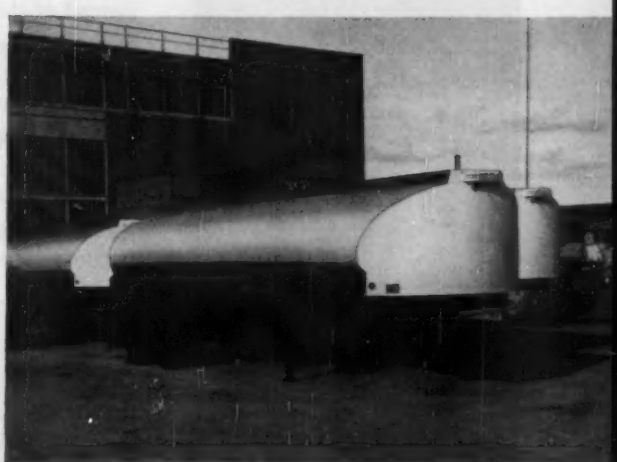
COMPARTMENT SEPARATORS ARE WELDED on special holding fixture. Wire pulling Fillerarc gun reduces jamming, cuts maintenance time.

tank production 35% at Heil Company

Fillerarc welding is General Electric's consumable-electrode, gas-shielded process for either semi-automatic or automatic welding. Now, using carbon dioxide gas as the shielding agent, the Fillerarc system is ideal for mild steel applications. It is fast, economical, clean (no messy flux to bother with), AND, the welds obtained are sound, weld after weld.

For a demonstration of the Fillerarc process, contact your nearby General Electric Welding Distributor. He is listed in the yellow pages of the telephone book. Or, write for more information to Section 713-8, General Electric Company, Schenectady, New York.

NOW AVAILABLE—New Buyer's Guide for General Electric's complete line of arc-welding equipment, electrodes, and accessories. Publication GEC-1033A. Write for it today.

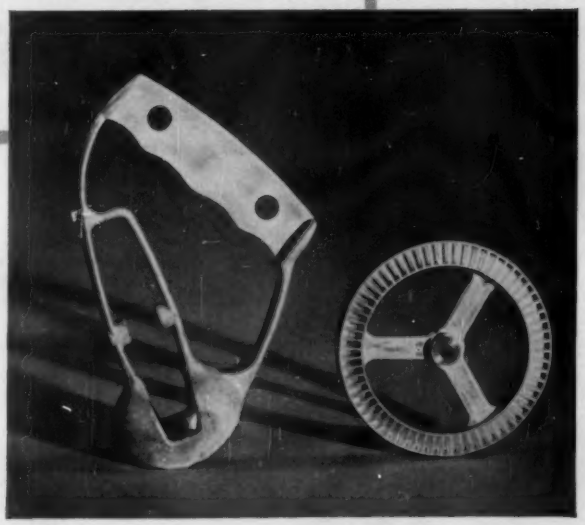


FINISHED PRODUCT—an aluminum petroleum tank, fabricated with Fillerarc welding equipment. Capacities of these tanks run from 3,000 to 9,000 gallons.

There's a Good Reason why

ZINC DIE CASTINGS

are so widely used



at

TURNER & SEYMOUR

it's

ECONOMY

Two-piece construction instead of six for the frame, gear housing, shield and drive gear on this modern egg beater is an excellent pattern for major production economy and improved design possible with ZINC DIE CASTING. Built to a toolmaker's precision, this durable and smooth-running household necessity is made by The Turner & Seymour Manufacturing Company.

LOWER PRODUCTION COST—An assembly of stampings, used for older types of beaters, require six or eight parts instead of the two ready-to-use ZINC DIE CASTINGS.

SIMPLIFIED ASSEMBLY—The gear housing and cored holes for crank, beater shafts and gears are cast in the frame. Parts fit together accurately for simple assembly without machining.

IMPROVED APPEARANCE—The flowing, modern design and smooth finish of the castings provide a perfect base for a bright chromium plating accented by black plastic handle faces.

Any die caster will show you how these money-saving and quality-improving benefits can be applied to your products.

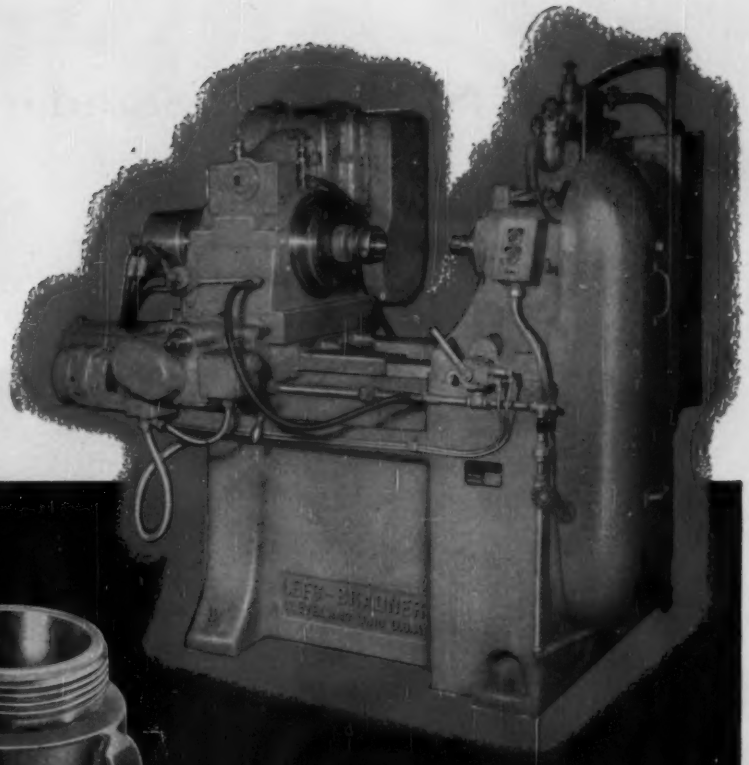
THE NEW JERSEY ZINC COMPANY 160 Front Street, New York 38, N. Y.

The research was done and the Zamak die casting alloys were developed with

HORSE HEAD SPECIAL (99.99 + % Uniform Quality)

ZINC
FOR DIE CASTING ALLOYS

It took this HIGH-SPEED Heavy-weight to lick this tough job!



The Lees-Bradner Special High Speed Thread Milling Machine

The Lees-Bradner Special Thread Milling Machine really shows its class when it works with brass!

The Akron Brass Manufacturing Company of Wooster, Ohio produces these threads, internal and external, each in 13 seconds with a 5000 RPM cutter spindle speed.

This is just one example of the many threading jobs that the modern, high speed, Special Thread Milling Machine can do better, faster and with unmatched precision.

Write The Lees-Bradner Company for full information on this remarkably versatile machine.

DETAILS ON THIS JOB

Hob Spindle Speed, 5000 R.P.M.
(Using a high speed cutter spindle)

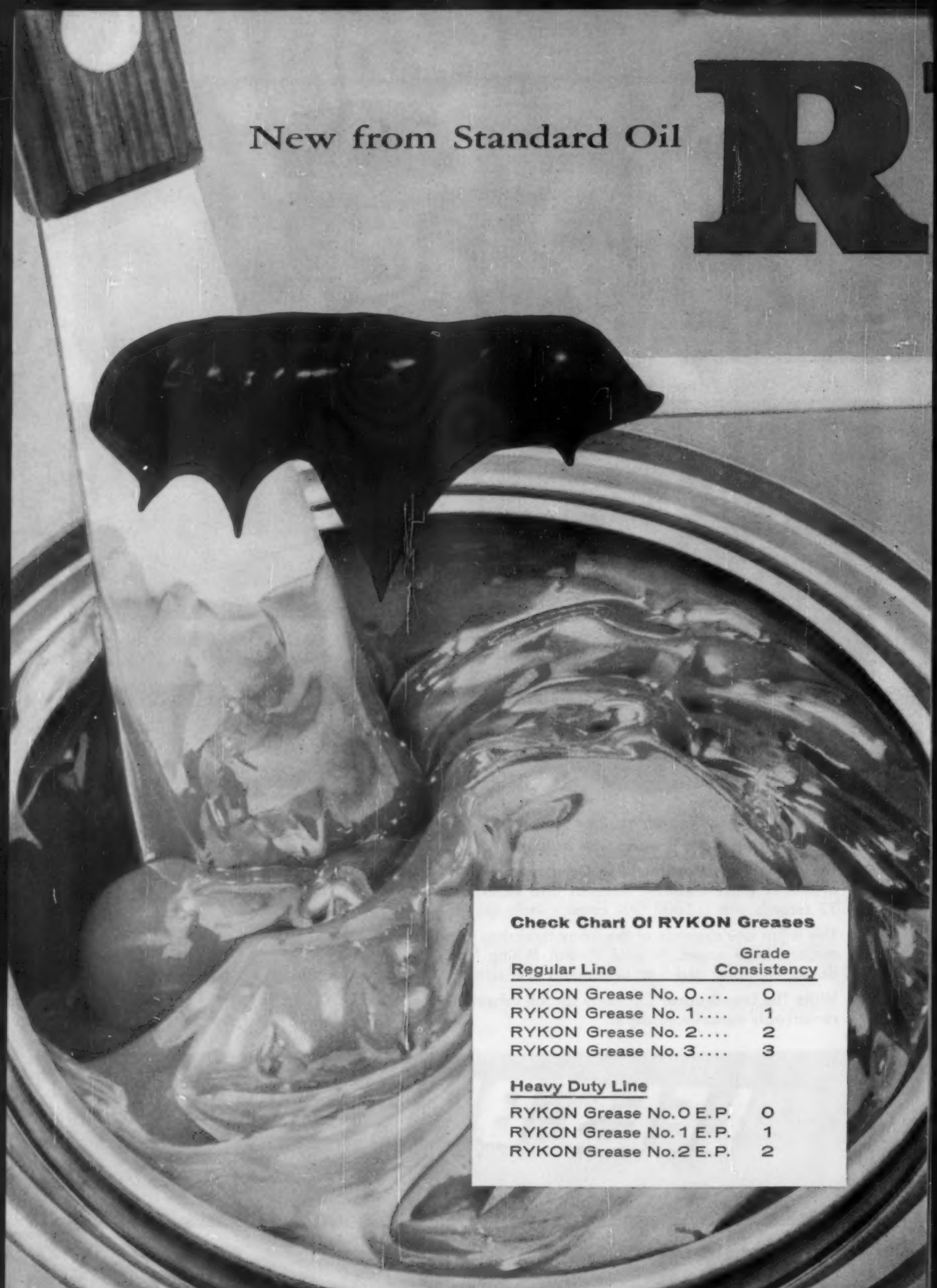
Thread Pitch (internal and external)	7½
Thread Diameter	3"
Length of Thread	¾"
Threading Time	13 seconds
Material	Brass
Weight of Parts	
Internal thread	1 lb. 13 oz.
External thread	2 lb. 10 oz.

the LEES-BRADNER Company

CLEVELAND 11, OHIO • U.S.A.

New from Standard Oil

R



Check Chart Of RYKON Greases

Regular Line	Grade Consistency
RYKON Grease No. 0....	0
RYKON Grease No. 1....	1
RYKON Grease No. 2....	2
RYKON Grease No. 3....	3
Heavy Duty Line	
RYKON Grease No. 0 E.P.	0
RYKON Grease No. 1 E.P.	1
RYKON Grease No. 2 E.P.	2

YKON

GREASE

Standard scores major breakthrough in grease technology to bring you better lubrication...help you make important savings in grease use, application and inventorying.

Scientists at Standard Oil, after several years' research, have developed a new non-soap, organic grease thickening agent. This new thickening agent, plus other improvements in grease formulation, is now available in a new line of Standard Oil greases named RYKON. RYKON Greases have all of the desirable properties of the finest quality greases—but to a greater degree. Here are data on the characteristics of RYKON Greases:

Mechanical stability—RYKON Greases show minimum change in consistency under severe mechanical working . . . do not thin out excessively in service.

Oxidation stability—Thickener in RYKON Greases inhibits the absorption of oxygen which prevents free movement, results in bearing corrosion.

Water resistance—RYKON Greases do not lose consistency in presence of water. Resist water washout.

High temperature stability—RYKON Greases have an ASTM dropping point of over 480° F. They have greater heat stability than other petroleum oil greases. At sustained high temperatures, RYKON Greases remain soft and grease-like longer. High temperature range permits the broadest possible application.

Oil separation—There is a minimum bleeding of RYKON Greases in service and in storage.

Wide temperature range — Ability of RYKON Greases to lubricate over a wide temperature range makes them truly multi-purpose greases.

Rust preventive properties—RYKON Greases demonstrate a superior ability to prevent rust.

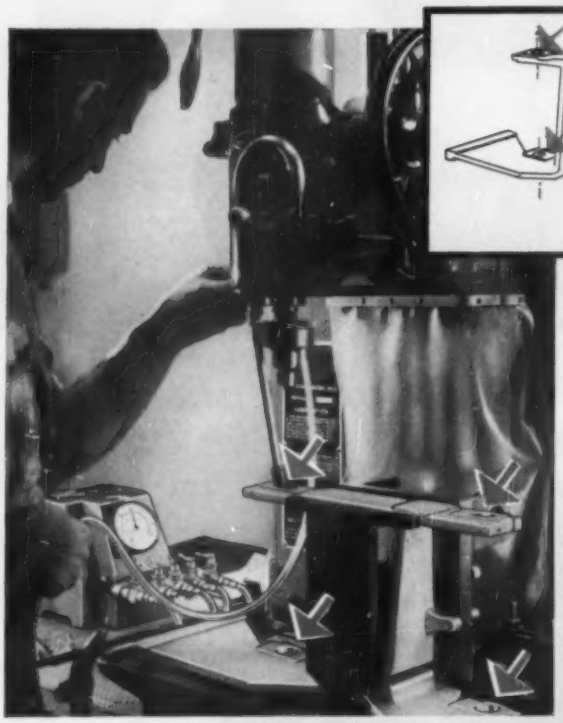
RYKON Greases are multi-purpose. To meet specific grease lubrication problems, they are formulated in four regular and three heavy duty grades. There is a RYKON Grease to meet every lubrication problem.

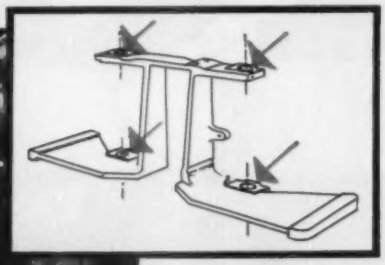
With a single RYKON multi-purpose grease doing all jobs in the plant, there's no wrong grease to use. Money invested in grease inventories is cut, storage and application facilities are reduced and maintenance training is simplified. Get the facts about RYKON Greases from the industrial lubrication specialist in the Standard Oil office nearest you in any of the 15 Midwest and Rocky Mountain states. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD

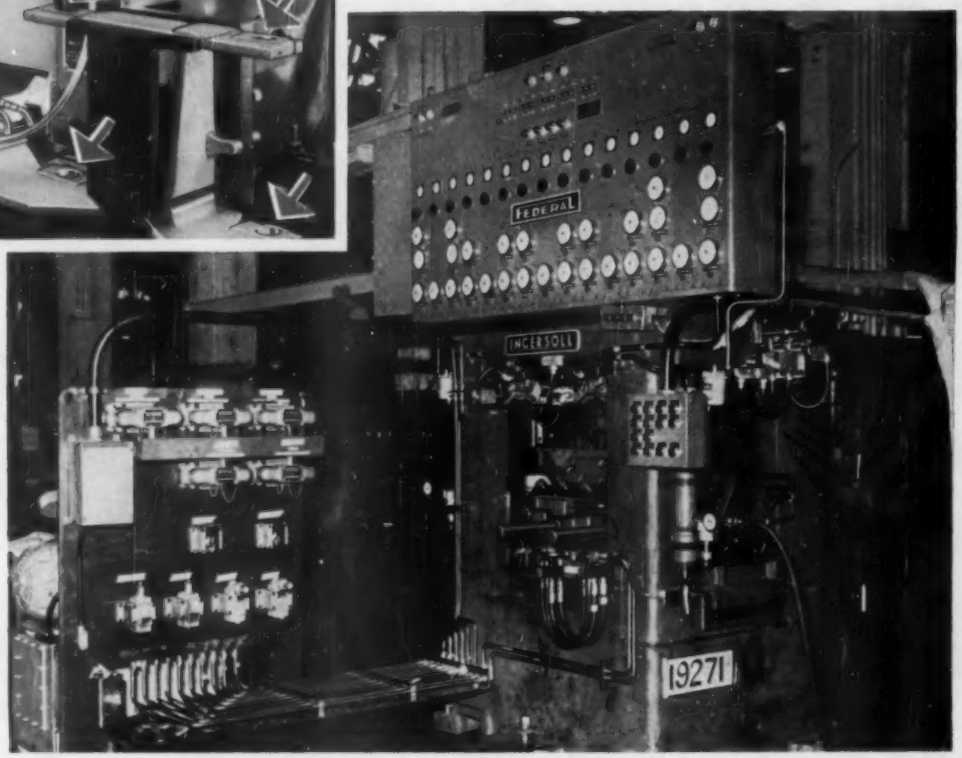
STANDARD OIL COMPANY (Indiana)

THEY GAGE THESE





This application at the Arrow Tool Company, Inc., illustrates the adaptability of the Dimensionair. Here it is equipped with a 5-way manifold to which different gaging units are attached ready for other jobs. On this job a Model A-1250 Adjustable Bore Gage is used to inspect 4 holes. Note that with this particular gage the handle does not have to line up with the hole. Many other jobs, having tolerances from .0004" to 50 millionths, are inspected by this Dimensionair.



Federal air-electric gaging and classifying equipment was used in this gaging station on an engine block transfer line. Two diameters in each of five crankshaft bores and two each in five camshaft bores are measured — twenty holes in all. After automatic assembly, oil holes in the five bearing liners are checked for alignment with the holes in the camshaft bores. All conditions are checked simultaneously. Signal lights indicate all dimensional conditions. Unsatisfactory blocks are automatically rejected. Cycle time is well within production cycle time. Ingersoll Milling Machine Company supplied the handling and positioning units.

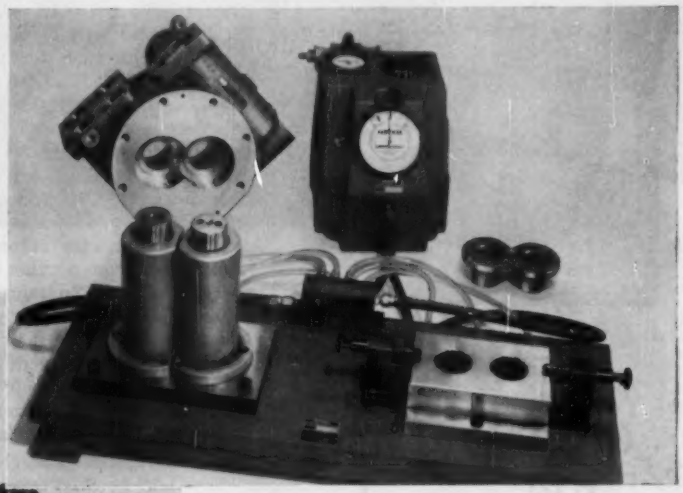
JOBS BETTER

with the DIMENSIONAIR

The increased complexity of more and more of today's gaging requirements calls for the utmost in dependable accuracy. So many times the accuracy of one dimension is dependent upon the accuracy of another. Automation, too, brings in another set of complications where misbehavior of the gaging process can upset your whole schedule.

The dependable no-drift accuracy of the Dimensionair is of the utmost advantage in such cases. Its reliability keeps quality up and keeps production rolling. Even on the simpler jobs the dependable no-drift accuracy and the foolproof operation of the Dimensionair are definitely appreciated. Call on us if you want to do a better gaging job. See our address below.

Two differential type Dimensionairs are used on this precision assembly. The first step is shown at right. Parallel bores in a gear-type fuel pump housing are located on the twin gaging plugs and the bushings that are to be pressed into these bores are placed in the twin ring gage at the right. The Dimensionair shows whether the flange flats on the bushings will have the proper clearance when bushings are assembled in the housing.



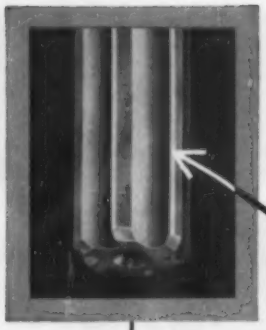
A second gage is used for the next step. After the bushings are inserted in the housing, they are located on the left hand pair of gage plugs. Then, a different set of bushings for the cover plate is placed on the right hand plugs. The single dial on this gage shows whether the center distances in the two pairs of bushings are the same within a tolerance of ±.0005". If the first two cover plate bushings measured do not meet this standard, others can be tried until a pair is found that does. Proper alignment of these bearing surfaces is assured at final assembly.

FEDERAL PRODUCTS CORPORATION • 7125 EDDY STREET, PROVIDENCE 1, R. I.

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging



This edge cuts reaming costs

L+I gives you the edge on production

Call your L+I distributor

The Reamer Specialists

L&I

LAVALLEE & IDE, INC.
CHICOPEE, MASS.

Letters...

To American Machinist
330 W 42nd St, N Y 36, N Y

Tool Control

Dear Sirs:

In reference to the questions asked in the "Moonlight Requisitions" letter (*AM*—Apr 22 '57, p100), here are a couple of ideas for consideration:

1. Working for the Navy, we have to provide our own basic tools—about $300 worth—but the Navy supplies each man with the special tools needed for his job. The special tools are supposed to last a stated period of time, with normal allowance for wear and tear, theft, etc. The yare marked as Navy property, and periodic reports have to be filed by the personnel, stating how many of them are held on a given date. The reports are verified by spot checks.

2. Another idea is one that is used by some of the shoe factories in New England. When a worker is supplied with tools, he makes a deposit on them. The value of the tools is deducted from his paycheck, and the money is held in escrow, at interest, against the return of the tools.

Hugh C Speer
South Boston, Mass

"Orphan" Found in Ad

Dear Sirs:

It has been most interesting to resume my acquaintance with *American Machinist*, particularly the advertisements, after a lapse of about twelve years—that is, since the American machine tool advertisements were discontinued in the English edition of what was then known as *The Machinist* and now as *Metalworking Production*.

It has also been very interesting to see which companies are still advertising. Some of the big ones have grown bigger by acquiring others; there are many new ones; and it is most unfortunate to see that so many of what were once common shop names are now missing.

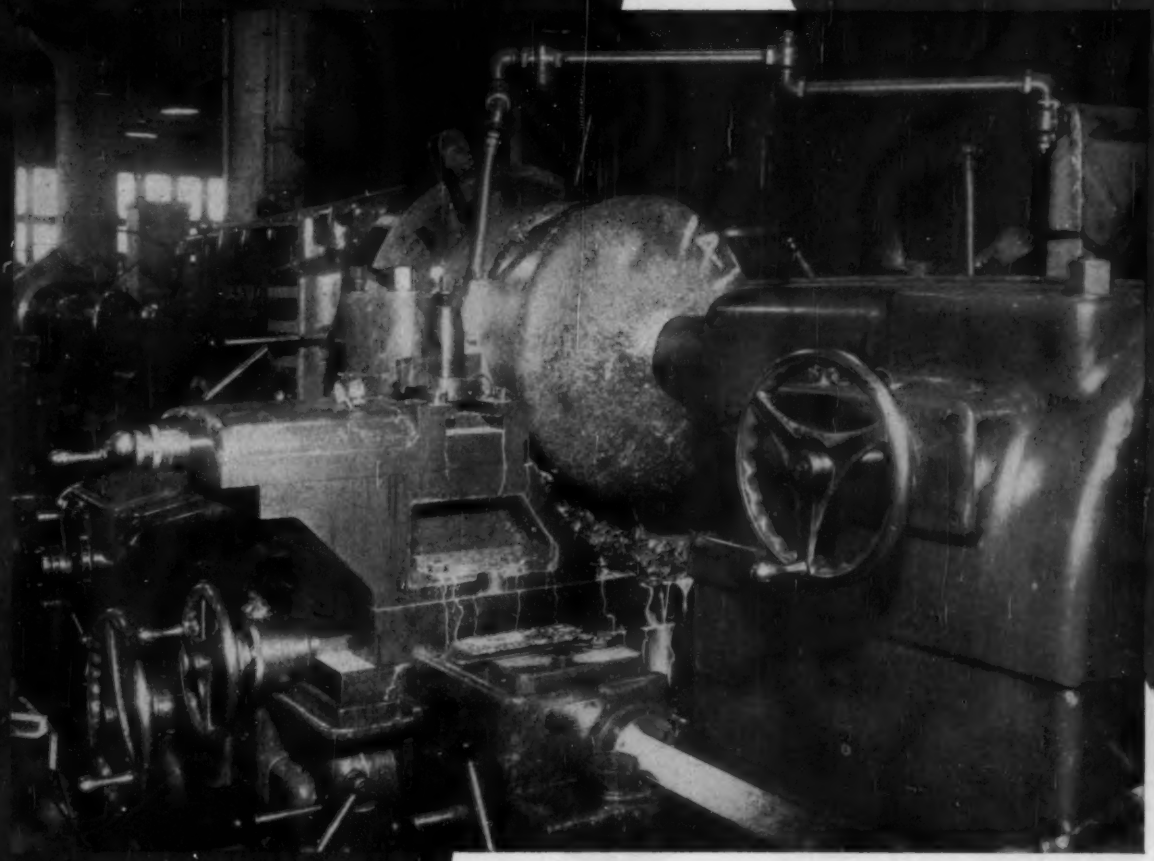
I have had it in mind to write to you for some weeks now, but what finally sparked off this letter was the inquiry regarding two old-time lathes in a letter titled "Orphaned Machines" (*AM*—Mar 25 '57, p101). Since then, I have found three ads of the Cisco lathe, and one of them is in your Fiftieth Anniversary issue published over here on June 25, 1927.

(Continued on page 100)

SHOPMATES

N. Jarvis

I AM CAREFUL— I HAVE LIGHT HAMMERS FOR THE TOOL HOLDERS AND HEAVY HAMMERS FOR THE TOOL SLIDES- TURRET-CAMS ETC.
I TOLD YOU SO. HE DOES IT ALL THE TIME, LES!
"MACHINES DON'T WEAR OUT." (THEY ARE BEAT TO DEATH)



"AMERICAN"

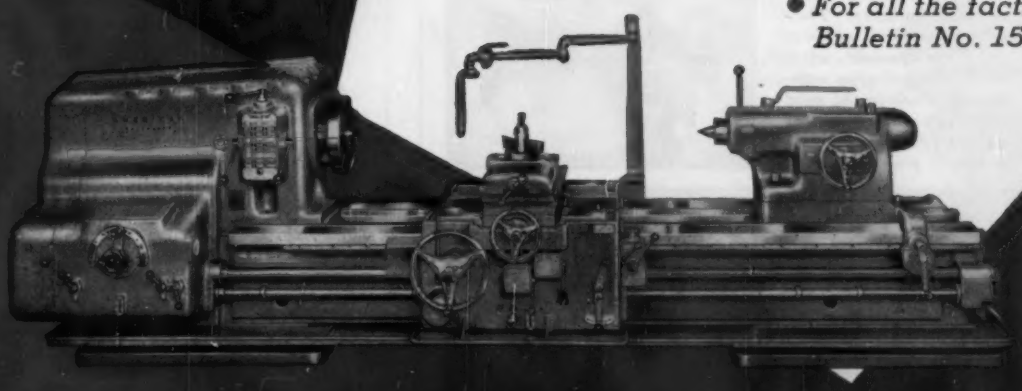
"Scalping" a $12,000 TITANIUM Ingot...

The operation shown by the accompanying illustration is "scalping" (cutting) the hide off of an ingot of pure titanium sponge. The ingot is 25" in diameter and the skin or hide that must be turned off is from ½" to 1" thick.

Due to the terrific cutting resistance of this "hide" low cutting speeds and exceptional ruggedness and rigidity are essential to satisfactory tool life.

Because power, rigidity, ruggedness and inherent stamina are outstanding characteristics of "American" Pacemaker Lathes they have been selected for this severe service by all of the major titanium fabricators.

• *For all the facts ask for Bulletin No. 150.*



THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

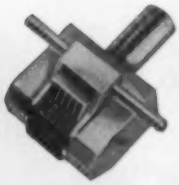
new NOBLEWEST
MARKING MACHINE
air-marks
2500
pieces per hour
AUTOMATICALLY

FEATURES
Cyclomatic Control

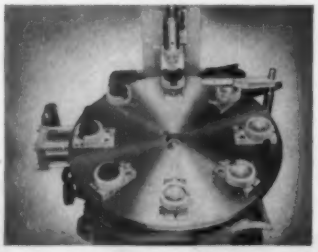
This new Model 400 dial feed marking machine is another example of NOBLEWEST'S unique ability to provide industry with high speed equipment for permanently indented marking . . . *good for the life of your product.* Featuring an air operated press head and dial feed, the basic model incorporates NOBLEWEST CYCLOMATIC Control . . . an exclusive electro-pneumatic circuit which provides continuous automatic cycling at any speed to suit operator. Supplementary controls for semi-automatic operation from a foot switch, for short runs, are also provided as well as independent operation of press head and dial feed for set-up purposes.

If you have a marking or numbering problem in steel or other metals—wood fibre, hard rubber, or plastic—NOBLEWEST makes the machines, dies and work-holding fixtures for doing the job *better, faster* at *lower cost.* For new comprehensive catalog, write Noble & Westbrook Mfg. Co., 17 Westbrook Street, East Hartford 8, Conn.

This close up shows Model 400 tooled for serial numbering plastic part shown above. Operator simply loads dial, parts are then automatically ejected after being numbered.



NOBLEWEST Automatic Numbering Heads such as used on the machine at right are standard in the marking industry. They offer unlimited applications for constant, selective and consecutive numbering. Made to the most exacting standards of quality, they are competitively priced.



MARK IT BEST WITH
NOBLEWEST IMPROVED MARKING DEVICES
NOBLEWEST
ORIGINATORS OF THE ROLL MARKING PROCESS
EQUIPMENT FOR MARKING · GRADUATING · EMBOSSING · NUMBERING

I am enclosing one of these ads herewith.

I have not yet found any ads of the Rahn-Larmon lathe, although the name is familiar to me. Should I come across any, I will send you one.

You will have gathered that I am what they call an "old timer" now, yet I am still working at the trade and am at present on an 18-in. Monarch-Keller Profile Turning Lathe and have been since it came into this shop new ten years ago.

I have now received ten issues of *American Machinist* and am pleased to see Fred H Colvin's name still in your list of officers.

J H Davis
Wembley, England

Thanks for the kind words and for the detective work on these old machines. Now, to answer one of Reader Holden's questions, the advertisement says that the Cisco lathe was made by The Cisco Machine Tool Co, 1769-76 Elmore St, Cincinnati. However, from all we can find out, the company is no longer in existence, and the answers to the other questions—who originally bought the machines, when, and at what price?—are probably buried somewhere in long-forgotten files.

As a result of the letter from Reader Davis, we did a little sleuthing in our own library and found that Cisco started advertising in American Machinist *in Oct 1923. For two years they inserted*

Helpful Henry

by L. Hoppes

"Ed's over there sleeping. I don't want him to get blamed for not coming to work today!"

two ads every month. Then they dropped down to one a month and continued at that rate until March 1929, and then there was nothing more. Possibly the company folded up at about that time. Does this bear out the old adage: "It pays to advertise"?—Ed.

Punch Grinding

Dear Sirs:

In my letter (*AM*—Sept 24 '56, p96) answering V Priddy's question about the grinding of piercing punches up to ⅜-in. dia (*AM*—July 16 '56, p93), I mentioned that small surface grinders and toolpost grinders are about the only methods available in the shop; and I made the guess that centerless grinding is the method used in the commerical manufacture of small piercing punches.

Now I find that my guess was correct. In fact, since that time, I have seen advertisements of accessories, where it is clearly stated that the perforating punches are produced by centerless grinding. One such ad was published by Ross Equipment Co, Inc, 81 College Ave, Rochester 7, N. Y.

Federico Strasser
Santiago de Chile

More About "Orphans"

Dear Sirs:

You asked if any of your readers can provide information about some old, worn out machines. I would like to volunteer the information that they probably ought to be scrapped. After all, how depreciated can a machine *get?* If it won't do the job it's supposed to do, even after being rebuilt, it seems about time to get a new one, or at least a newer used one.

Of course, that takes some capital, but, when you compare the output of a modern machine tool with the output of an old clunker, it's very apt to be a good, sound investment.

Frank McDonald
Pittsburgh, Pa

THIS BOOKLET . . .
Simplified Our Tool Planning and Helped Us Speed Up Production
WITH OUR
REED
Thread Rolling Attachments

Application and Operating Instructions:
REED THREAD ROLLING ATTACHMENTS SERIES B, TWO-ROLL TYPE
REED ROLLED THREAD DIE CO.
Worcester, Massachusetts, U.S.A.
Application Procedure
Setup and Operating Instructions

Engineers, setup men, operators . . . all find helpful information in this booklet, "Application and Operating Instructions," furnished with every Reed Thread Rolling Attachment . . . and available to manufacturers tooling machines for thread rolling.

It furnishes data to help reduce operating costs and produce high quality threads. With this booklet, setup men without previous thread rolling experience have successfully completed the setup for production.

REED Engineering Service . . .

- **Complete Technical Information** for the selection of equipment and tooling for your requirements.
- **Highly Skilled Personnel** to assist with the initial installation as well as subsequent threading applications.

STANDARD SIZES IN STOCK

Write for Attachment Application Booklet B-101

REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

WORCESTER 1, MASSACHUSETTS, U. S. A. TRA181

Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto

NEW STARRETT DIAL TEST INDICATOR

Sets up in seconds...Handles any gaging job

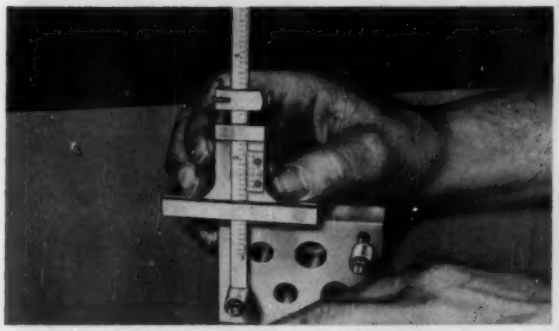
You'll marvel at how fast this new Starrett No. 675 test indicator can be set up . . . and at the easy way it handles any gaging job on the bench or around machine tools. Complete flexibility of adjustment plus extreme rigidity make it an ideal all-purpose test indicator. A quick-positioning swivel post snug, sensitive fine adjustment and swiveling indicator clamp are a few of its many unique features.

You expect time-saving, money-saving advantages when you insist on Starrett precision measuring tools for the shop. You get the same benefits when you standardize on the many other fine products made by the world's greatest toolmakers. Specify Starrett when you buy mechanics' hand measuring tools and precision instruments, dial indicators and dial gages, steel tapes and rules, hacksaws, hole saws, band saws and band knives, and precision ground die and flat stock. All of these Starrett products are available through your local Industrial Supply Distributor — a convenient and reliable source of supply.

WHEN YOU MEAN PRECISION YOU SAY STARRETT

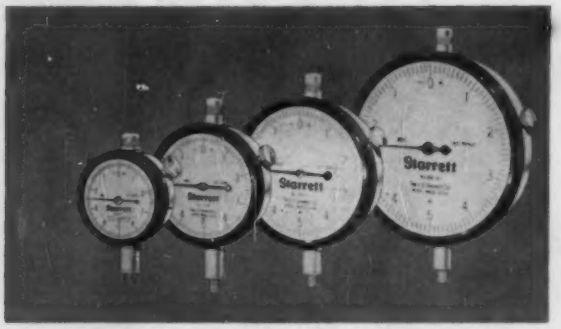
OTHER FINE PRODUCTS MADE BY STARRETT

"The Name You Know and Trust"



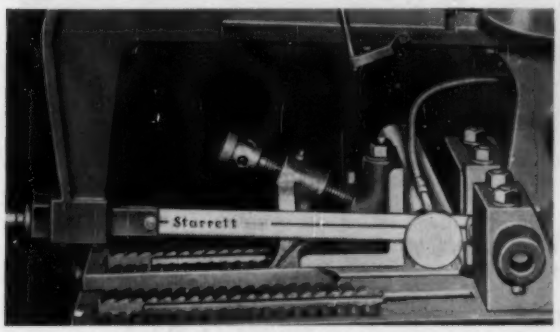
MECHANICS' HAND MEASURING TOOLS — STEEL TAPES, STEEL RULES AND PRECISION INSTRUMENTS

The name Starrett on tools is the hallmark of precision — a guarantee of accuracy, fine workmanship and complete dependability.



DIAL INDICATORS AND GAGES

Standard for quality and precision — a complete line for every gaging or production inspection application.



HACKSAWS, HOLE SAWS, BAND SAWS AND BAND KNIVES

Precision made by the World's Greatest Toolmakers for top performance, uniformity and maximum cutting economy.

PRECISION GROUND DIE AND FLAT STOCK

Made in four types, all sizes — air, oil, oil or water, and water hardening. Look for STARRETT, the mark of precision, on every piece.

BIG NEW CATALOG NO. 27

Describes and illustrates the complete Starrett line.

Ask your Industrial Supply Distributor or write for free copy. Address Dept. C, The L. S. Starrett Company, Athol, Mass., U. S. A.

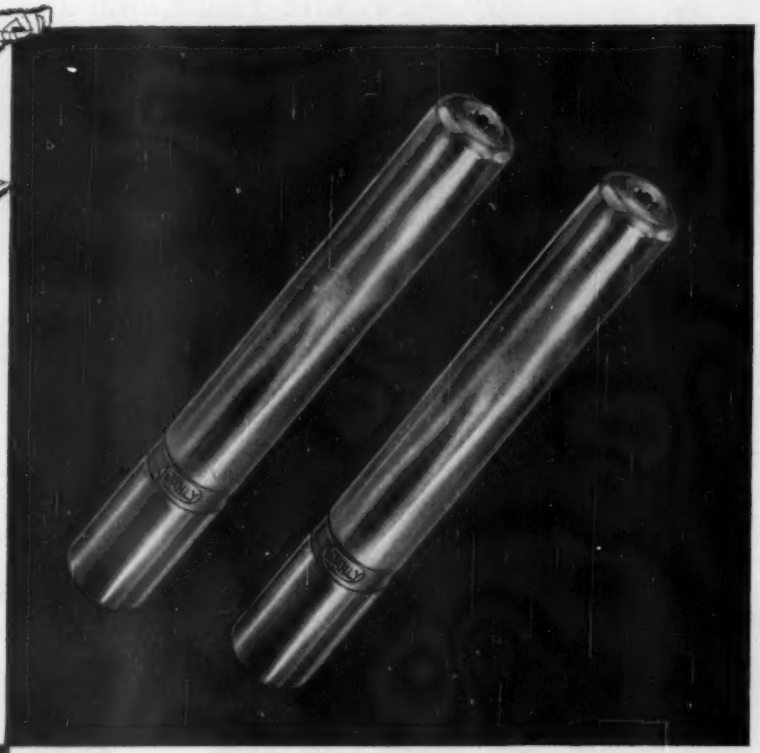
Starrett

Buy THROUGH YOUR INDUSTRIAL DISTRIBUTOR
Prompt delivery
Dependable service
Quality products

SINCE 1880
WORLD'S GREATEST TOOLMAKERS

HAND MEASURING TOOLS AND PRECISION INSTRUMENTS
INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK
HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVES

NEW "Microme" chrome plated guide posts



ON NEW DANLY DIE SETS

Now standard on all Danly precision die sets, MICROME chrome plated guide posts typify Danly leadership in die set design. Years in development, they represent only a part of Danly's never-ending effort to provide the finest in quality. These new posts are extremely hard and have very high resistance to wear. Super smooth finish helps to guarantee lasting precision performance . . . they are another important reason why you should specify Danly die sets.

Leading industrial distributors and Danly branch assembly plants—located in all major tooling centers—stock Danly Die Sets for fast delivery.

DANLY

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue
Chicago 50, Illinois

Spot news...

- **An "empire" of aircraft components manufacturers may be a-borning.** Financier-industrialist Frederick W Richmond, who has collected a variety of companies in his 33 years, is seriously thinking about integrating aircraft component manufacturers into the industry's biggest manufacturing-marketing setup.

- **Brazil's foreign-capitalized automotive industry** continues to grow by leaps and bounds. With Chevrolet, Ford and Germany's Mercedes-Benz already set up at Sao Paulo, along with a host of supplier organizations, Volkswagen is now getting into the act. It will manufacture pickup trucks with 40% made-in-Brazil parts, has gotten a $2,235,000 loan to do so. Also headed for Brazil: Italy's Alfa Romeo, France's Simca, Sweden's Volvo.

- **You'll see sales of more than $10 million worth of used machine tools** within the next 60 days. Industrial Plants Corp will liquidate used machines from Curtiss-Wright, Philco, Crosley, Pressed Metals, the former Atwater-Budd plant, Yale & Towne, Studebaker-Packard and Mars Engineering, among others.

- **X-ray that can analyze a given element in alloy steel in 10 seconds,** or magnify the atomic structure of materials 150-million times, has been installed at Buick's Flint, Mich, metallurgical lab.

- **Air suspension systems are a certainty for some 1958 automobiles**—Cadillac's Brougham and Coup de Ville, the Buick Roadmaster, and optional at a price tag of $160 to $180 on the entire Chevrolet line.

- **Industry will get a chance to use a 24-million-volt betatron** during its "time off" as a cancer research weapon at Madison Radiation Center, Madison, Wis. It can be used to x-ray castings, do other metalworking jobs evenings.

- **Ford's Continental Mark II will no longer be a separate entity** in the Ford lineup. This fall, the Continental Mark III will appear as top dog in the Lincoln line, will cost $2000 less than its present price tag of $10,000.

- **Color x-rays may soon be a tool for the metallurgist.** Developed by Philco for medical research, it is 20 times as discriminating as the human eye in discriminating between lights and shadows on x-ray film.

- **Detroit may replace light-metal stampings with molded fiber material** in such automotive applications as inner door panels and arm rests because the latter are said to be much lighter, less expensive.

- **Machine tools and equipment have reached such a point of obsolescence** in many plants that quality control costs are as much as 80-90% of the total direct labor dollar, GE Quality Control Manager Armand V Feigenbaum claims.

- **Guided missile makers could conceivably use overtime pay as a worker lure** over aircraft and other defense-producing industries. Reason: missile makers are the only defense producers exempt from the Pentagon's new directive banning more than 2% of project cost for overtime on defense contracts.

Spot index to major News stories...

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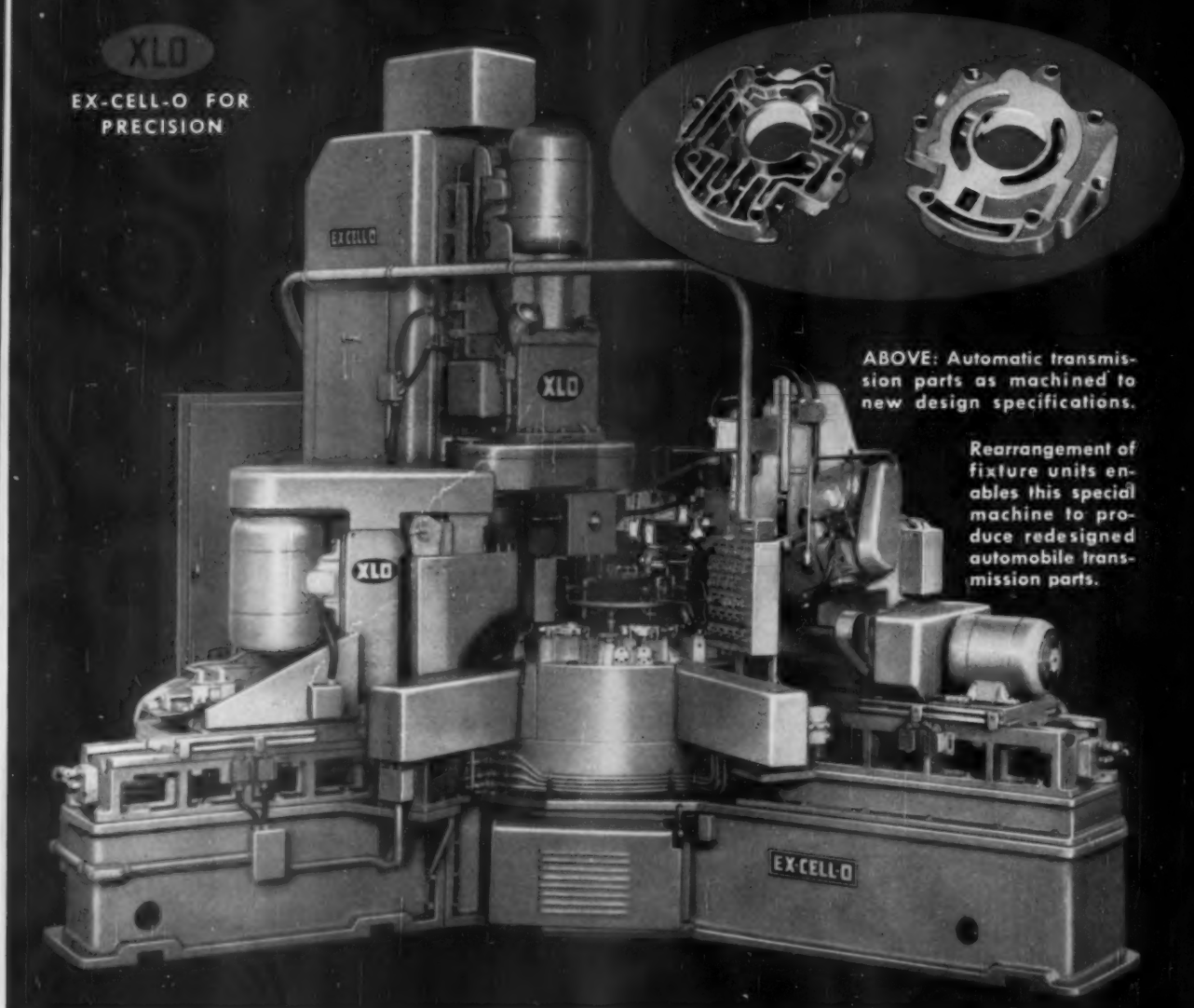
XLO

EX-CELL-O FOR PRECISION



ABOVE: Automatic transmission parts as machined to new design specifications.

Rearrangement of fixture units enables this special machine to produce redesigned automobile transmission parts.

Parts changes didn't obsolete this special

Easily Adapted to Altered Workpieces

The first big parts change to come along will obsolete many a special machine—at a drastic cut into the production budget! But not so with this Ex-Cell-O special now operating at full tilt in an automobile plant in Detroit.

Built to process regulator valve bodies for automotive transmissions, this special machine was flexible enough to adapt to certain changes in tooling and operational cycles. Right now, it's turning out complicated parts at the rate of 120 per hour.

Machining includes fly-cutting both flat sides of aluminum part; drill and ream two piston holes; drill three angular holes; drill, ream and chamfer the top holes. Flatness of the two sides is an important requirement.

Ex-Cell-O specials have the extra precision you have come to expect of XLO products. Why not check with your Ex-Cell-O representative today? Or write Ex-Cell-O, Detroit.

EX-CELL-O CORPORATION *Machinery Division*

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

57-26

Washington ... NEWS REPORT

Tight money and votes ...

The Democrats are going to try to make tight money their big campaign issue for next year's Congressional elections—and, if it works out, for the Presidential race in '60.

They're convinced there are votes to be had in talking up the shortage of credit and high interest rates as they affect the businessman who wants to expand, and the citizen who wants schools, public works, new housing and the like.

The thought is to hammer at the theme that it's the big businessmen and the bankers who are making big profits out of the "favorable business climate" in Washington—while the rest of the people suffer.

It's hard to say how much success this line will have, since the "soft spots" are relatively few and far between. But the issue will have staying power. Eisenhower has re-iterated his belief that tight money is better than inflation.

Anti-discrimination drive ...

The federal drive to end racial discrimination by government contractors is taking a couple of new turns. Vice President Nixon, chairman of the "President's Committee on Government Contracts," has asked the 26 federal contracting agencies not to sign any more contracts with companies who show "clear and convincing evidence" that they aren't going to comply with the non-discrimination clause in all government procurement contracts.

Up to now, the Committee has been using only persuasion, without actually threatening to withhold government orders.

The Committee also plans to publicize—by name—government suppliers who have taken steps to comply with the clause in all government contracts requiring the contractor not to discriminate against Negroes either in hiring or in promotion policies. The Committee won't publicize the names of contractors who don't comply; the objective is to cut them off from additional government business.

Labor clean-up coming ...

The showdown stage is nearing in labor's anti-racketeering program. The AFL-CIO is insisting on a full housecleaning by the International Brotherhood of Teamsters if the truck union wants to remain part of the federation. This means a whole string of lower echelon officers must go—not just Beck and several vice presidents. It means, too, that the AFL-CIO intends a follow-through on an anti-rackets program that is likely to hit at least half a dozen unions.

Legislative remedies to union racketeering are moving more slowly. The Eisenhower administration wants health and welfare fund control this session, but nothing else until the heat's off. It wants to avoid penalty legislation.

Wages going higher ...

Government officials see a continuing rise in living costs—which in turn will help push wage settlements higher. This year's average per-hour increase will come out as high as 12-15¢—and it's bound to give the big industrial unions under long-term contracts an incentive for making even higher demands when they negotiate next year. The fact is that this year's "automatic" increase will outdo what union negotiators have been able to win in recent years.

So far, most major unions under long-term contracts—such as the steelworkers and the UAW—have collected 3¢ an hour in living cost advances. Another 3¢, at least, is likely before the year is out. Add to this a minimum 6¢ per hour in deferred pay boosts.

UAW will want more ...

Unions such as the UAW aren't going to be satisfied with a moderate increase in the next round of bargaining in mid-1958. Living cost increases, they argue, are real wage advances. Too, they cite a reduction in working hours and loss of overtime pay that's showing up in 1957 factory pay figures as a reason for higher pay.

Employers who negotiate 1957 agreements are being hit by the automatic advances of workers under long-term agreements. Settlements are running just over the 10¢ level, matching last year's figure at this point. But, with big bargaining in oil, rubber and other industries still to come, the bargaining settlement figure is expected to be higher in the last half of the year.

Anti-antitrust fight shapes up ...

Long-awaited Senate Antitrust Subcommittee Report on Concentration is due any day now. It will form the basis of a long series of hearings by the Subcommittee, and a campaign against it is already in full swing in Washington. Automakers, for example, have prepared documents attacking concentration figures as "inadequate and inconclusive"—and Commerce Dept's Census of Manufactures, upon which the upcoming report is based, as "erroneous, inexact, incomplete, misleading."

BAY
STATE
Stroboscopic photo courtesy A. G. Spalding & Bros. Inc.
PRECISION
PERFORMANCE...
To the golfer, precision performance means muscular coordination, distance judgment, a good eye, and lots of practice.
To tap users, precision performance means production-line continuity, better threaded parts, increased tap life . . . and BAY STATE!
BAY STATE TAPS
Bay State Tap & Die Company
Mansfield, Massachusetts
On the shelves of your local Industrial Supply Distributor

Detroit ... NEWS REPORT

Output—up from '56 levels . . .

Up to now, automotive production for 1957 has been almost identical with that of 1956. But now it looks as though overall production will increase by 68,000 to 72,000 units per month in May and June.

And although production has been running 11% below that of 1956, it looks as if second quarter 1957 output will exceed that of second quarter 1956 by as much as 10%. Last year at this time, production was cut sharply, but it doesn't look like that will happen this year.

There is a strong feeling among automakers that second-quarter output will hit about 1.6-million cars. Some also feel this could lead to a soft third quarter—but not nearly as bad as the one last year.

Chrysler Corp's overall production is up 44% for the first four months of 1957 over a similar period in 1956 despite strikes and walkouts. Plymouth is up 40%, Dodge 57%, DeSoto 32%, Chrysler 20%—and 1957's hottest big car, the Imperial, has assembled four times as many cars this year. Ford reports that Mercury is "going well," but Lincoln output is the lowest so far this year—mostly because of new-plant assembly problems.

Ford sales are holding up, but its production has slumped to five days a week. The retractable hardtop is moving very well.

At General Motors, Chevrolet matched Ford's output total of about 30,000 units per week—although Chevvy production still lagged behind comparable 1956 by 14% in the first four months. Pontiac stayed about even with '56 output (just a hair over last year's first four months, so Pontiac becomes the only GM nameplate to outproduce 1956's first-four-month totals). Oldsmobile dropped 10% from its 1956 first four months. Buick is on a four-day week, and Cadillac is slightly under its 1956 pace.

At American Motors, Nash and Hudson's combined output is less than 200 units a week—50% off from comparable 1956. Rambler is running steady at 2150 units a week with April production 73% ahead of April 1956.

Studebaker-Packard's January-through-April output is down 42% from 1956 on Studebakers, while Packard is hitting a this-year's low.

The new auto materials . . .

The next few years, and in some cases the next few months, will see radical changes in materials and methods for the production of automobiles, as auto stylists and materials research men get an increasingly bigger say-so in the industry. Here's what they see in the crystal ball:

• **ALUMINUM** is slated for more and more use as designers and engineers delve into new uses for it. For one thing, you can look for new roofs of aluminum, both in painted and "brushed" finishes. Designers say roofs will be either all-aluminum or steel-decorated aluminum.

Bumpers will go to aluminum in many cars, but there's quite a debate over how the bumpers will be made. Some designers feel that a combination of aluminum and scuff-resistant vinyl plastic inserts are the answer. Others feel that inserts should be of steel or of rubber.

Aluminum will replace zinc die castings in headlight and taillight bezels. Radiators, too, will go more and more to aluminum, but very probably the water passages will still be copper because aluminum soldering isn't everything it should be from the standpoint of repair. And beginning with the 1958 models, transmissions will be loaded with Al castings and extrusions.

Increased use of aluminum is going to mean some changes in forming machinery and dies, because it's easier and cheaper to work with equipment specifically designed for aluminum than to use makeshifts and conversions.

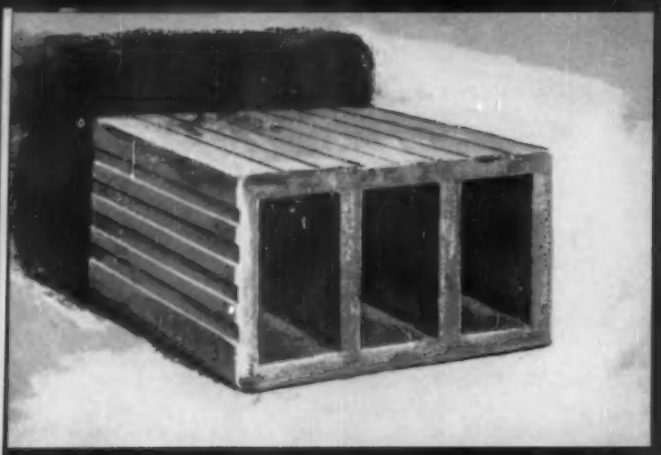
• **STAINLESS STEEL** is still a potent factor in automobile trim and construction. In some of the better cars, stainless will show up increasingly in headlight and taillight bezels.

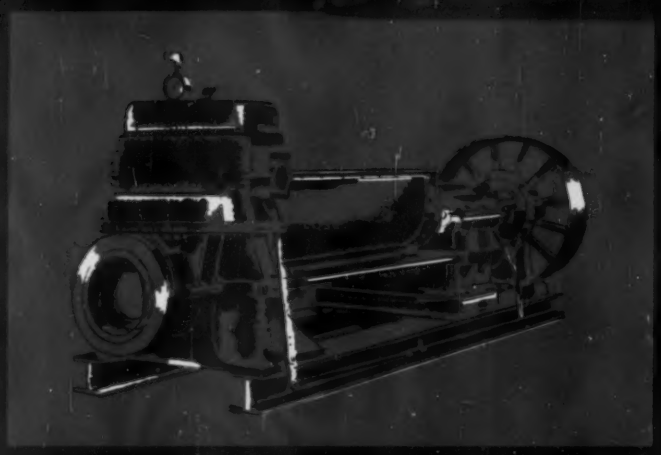
And stainless will not be replaced by aluminum in the "splash areas" of a car. The corrosive salts and chemicals used in snow and ice removal rule out aluminum as a widely used metal in hubcaps and other close-to-the-ground areas. Use of stainless steel roofs, a la Cadillac's Brougham, will increase. And at least one manufacturer is finding that torque converter housings can better be made of steel than aluminum.

• **PLASTICS** are a wide-open automotive field for the designer and engineer. The automotive industry would like to see more developments in the glass fiber field—such as dashboards.

Nylon is increasingly replacing metal in small gears for water and oil pumps, and in speed and odometer gears. Nylons, too, are heavily favored to replace ferrous tubing for gas and oil lines.

• **ALLOY STEELS** are largely on the way out. Some cars have already cut use of this type of steel down to as little as 6%. With the advent of air suspension, this figure will drop even lower. Alloy steels are steadily being replaced by induction-hardened carbon steels and, in some cases, castings.





No Margin for Air—
No Margin for Error

ANOTHER DRIVE REQUIREMENT MEETS ITS MASTER

Yes, it's a fact—unless you remove the air from the clay, you get a no-good tile. And whether air is your problem, or not—error is always a problem. And it's never a mistake to come to Master for the right power drive. In every kind of industry, Master customized package drives give you the utmost in flexibility, compactness and performance.

Here, the primary requirement is power—and the husky, big 200 H.P. Master fills the bill year in and year out. Your requirements might be better met by integrating Master components into a single, efficient, compact unit for the right horsepower, right shaft speed and right mounting features. What are they?

A husky 200 H.P., 440 volt squirrel cage induction Master Motor powers this 14-ton De-Airing Brick and Tile Machine with a capacity of over 8000 bricks per hour. Two parallel shafts carrying pug knives work clay, pass it into vacuum chamber with auger cylinders where it is finished and discharged.

Motor Ratings	⅛ to 400 H.P. All phases, voltages and frequencies.
Motor Types	Squirrel cage, slip ring, synchronous, repulsion-start induction, capacitor, direct current.
Construction	Open, enclosed, splashproof, fan-cooled, explosion-proof, special purpose.
Speeds	Single-speed, multi-speed, and variable speed.
Installation	Horizontal and vertical, with or without flanges and other features
Power Drive Features	Electric brakes (2 types)—5 types of gear reduction up to 432 to 1 ratio. Mechanical and electronic variable speed units—fluid drives—every type of mounting.

MASTER

THE
MASTER ELECTRIC
COMPANY
DAYTON 1, OHIO

Machine tools ...

Replacement formula developed ...

Defense Department has developed its own machine tool replacement formula, the purpose of which is to act as a practical guide to all three service branches in deciding whether machines now in use should be replaced under Pentagon's much-touted replacement and modernization program.

Chief factor in the formula is what happens during the new machine's first year. The operating cost in that period is measured against the cost of keeping the old machine.

Estimated machine load, in hours, is the basis for the figuring. Ruled out is the use of figures stemming from round-the-clock M-Day requirements.

All the usual cost elements are considered. Fringe benefits are reported to be put at 16% of direct wages as a minimum. Cost of rebuilding and of a major overhaul is taken into account.

Formula is closely modeled after the MAPI formula but differs from it in important respects. MAPI was consulted in putting it together.

Though the formula is stiff, the services should have no trouble in coming up with enough cases in which replacement can be justified and all available funds used.

The Navy and the Army are said to have been won over to the new formula. Air Force has balked.

Defense Department hopes to persuade the Air Force to accept the formula. If it can't, it probably will issue a directive by mid June applying the formula uniformly to all three services over Air Force protests. This directive would supersede that of September 21, 1956.

Prices heading up ...

Price increases in machine tools appear to be inevitable as the year wears on. A few have occurred already. More will follow later on.

It has long been the habit of many builders to give their customers a chance to place orders at old prices before the new ones take effect. Some builders indicate that they are about to abandon this practice. They say that it makes little sense to put in new prices, and then load themselves down with business at the old prices.

Final report made on leasing ...

The government inter-agency task group charged with the job of arriving at a production equipment leasing policy for government-owned tools has made its final report to ODM.

The report has the solid support of all agencies except the Defense Department which happens to own most of the equipment affected.

The task group goes on record in favor of rental rates ranging from 1½% per month of the acquisition cost, for new equipment provided to a new lessee, to ½% per month for equipment 13 years old or older. Pentagon wants higher rates.

All lessees should pay rent into a common pool, the group recommended, to be drawn upon by lessor agencies for financing tool replacement.

Payments by means of lowering the prices of military end-products were frowned upon. Pentagon favors an end-product price-offset because it then gets more military items from the same Congressional dollar appropriation.

West Germany booming ...

West Germany's machine tool industry produced 255,700 metric tons of machines last year, a gain of 17½% over the previous year. Tonnage built in 1955, in turn, was 26% greater than in 1954.

Metal-cutting machine tools accounted for better than three-fifths of the tonnage. These figures do not include West Berlin, which added 5%.

New orders matched production during 1956. In the previous year, however, they outran shipments by 42%. Drop in new business was from domestic sources, perhaps traceable to higher discount rates in the federal banking system. Since the discount rate began to be eased last September, orders have risen.

About 36% of West German machine tool shipments went abroad in 1956, most of them to Great Britain (biggest customer) and continental Europe. India and the United States were the best overseas markets, the latter taking some $6 million of tools.

West Germany imported more machine tools from East Germany and other communist-bloc countries than she sold to them. Total imports of machine tools from all sources amounted to only one-fifth of total exports.

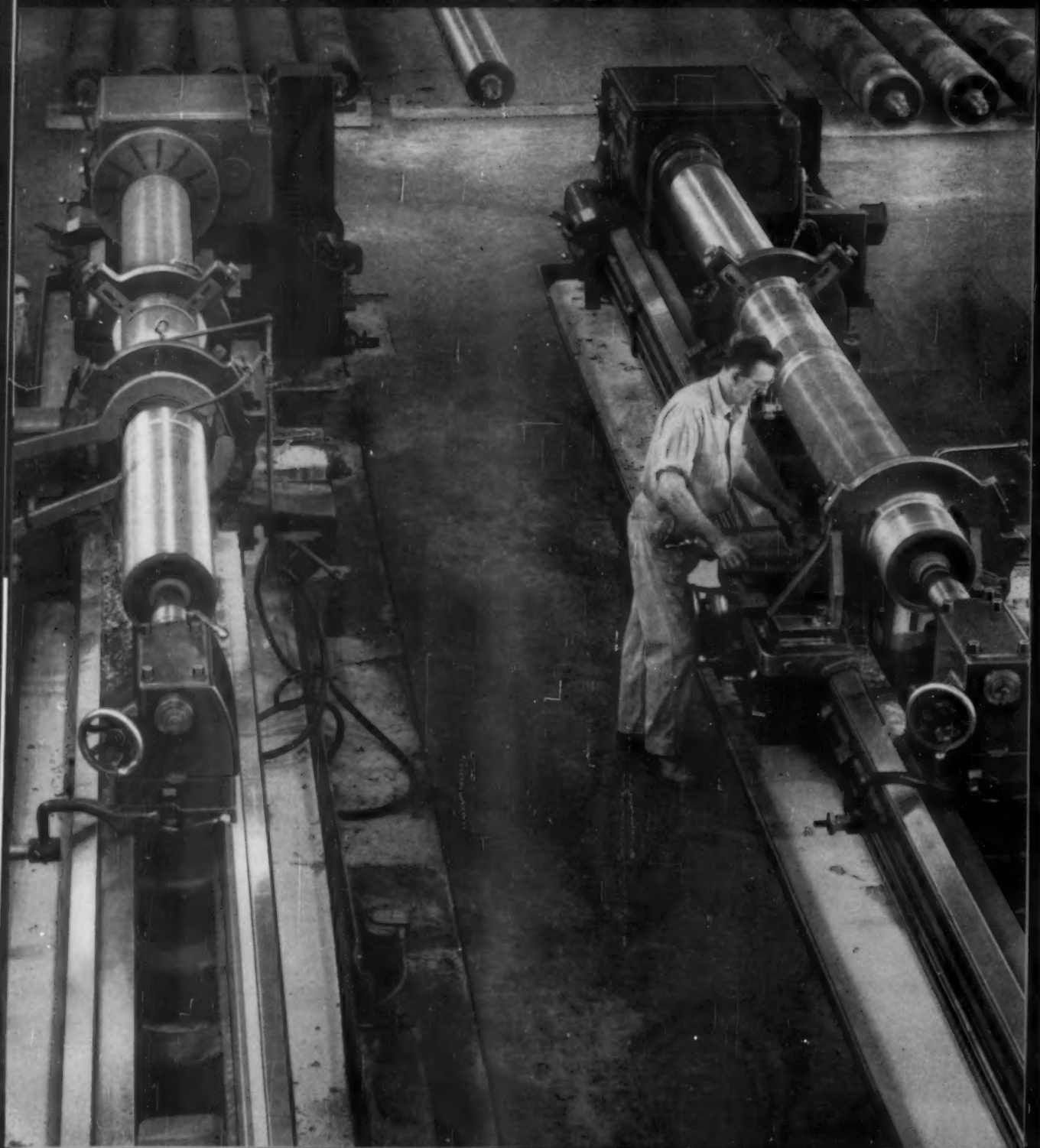
480 West German and West Berlin machine tool companies belong to VDM (Machine Tool Makers Association). Average employment is less than 150 per company, 72% being factory workers, 14% apprentices and 14% office employees. Shortage of craftsmen and engineers is reported the biggest deterrent to further expansion.

Work-week in West German metalworking was cut to 45 hr Oct. 1. New schedule was put into effect Jan. 1 in West Berlin.

BF

Beloit Eastern needed LeBlond

Two of the eight LeBlond 25" and 32" Heavy Duty Engine Lathes in Beloit Eastern's new pipe roll shop.



rigidity for this 3 in 1 turning idea

Finishing tool is mounted on back of special follow rest.

LeBlond lathe owners often tell us about unusual ways they are able to use our machines. There's a reason. The rigidity, accuracy, weight—the unique features of LeBlond lathes encourage owners to expect a little more of them. With LeBlonds they confidently develop turning techniques that they just couldn't expect an ordinary lathe to handle.

Take this pipe roll "skinning" job at Beloit Eastern Corporation, Downingtown, Pa. These 23′ extruded wrought steel pipe rolls must mate perfectly in high-speed paper making machinery. This calls for straight and true machining accurate to .002 end to end—in itself, a stringent test of lathe rigidity.

But Beloit Eastern had to "skin" costs, too. So they took advantage of LeBlond's unique tailstock design with their unusual 3 in 1 turning idea. Now rolls are roughed, finished and polished all in *one* operation:

1. **ROUGHING**—Carbide tool is mounted on the compound.
2. **FINISHING**—A special solid ring-type follow rest (bolted to the carriage wings) carries a tool block and high-speed finishing tool.
3. **POLISHING**—A wooden emery paper holder made like a clamp is tied together against the turning pressure of the roll.

Spindle rigidity of the LeBlond tailstock, when greatly extended, actually makes this cost-saving method possible, since room must be made for follow rest at beginning of cut. The tailstock spindle even when extended, has full-length support thanks to exclusive LeBlond Thrust Lock design.

Ask any LeBlond lathe owner. He'll tell you he likes LeBlonds because he can count on them—for more rigidity, more usable power, more years of dependable, accurate turning. After all, isn't that what *you* want in a lathe? Today, get all the details on the complete LeBlond line of heavy duty turning machines, the most dependable lathes in the world. Call your LeBlond Distributor or write. *Ask for Bulletins HD-156 (25″) and HD-165 (32″).*

. . . cut with confidence

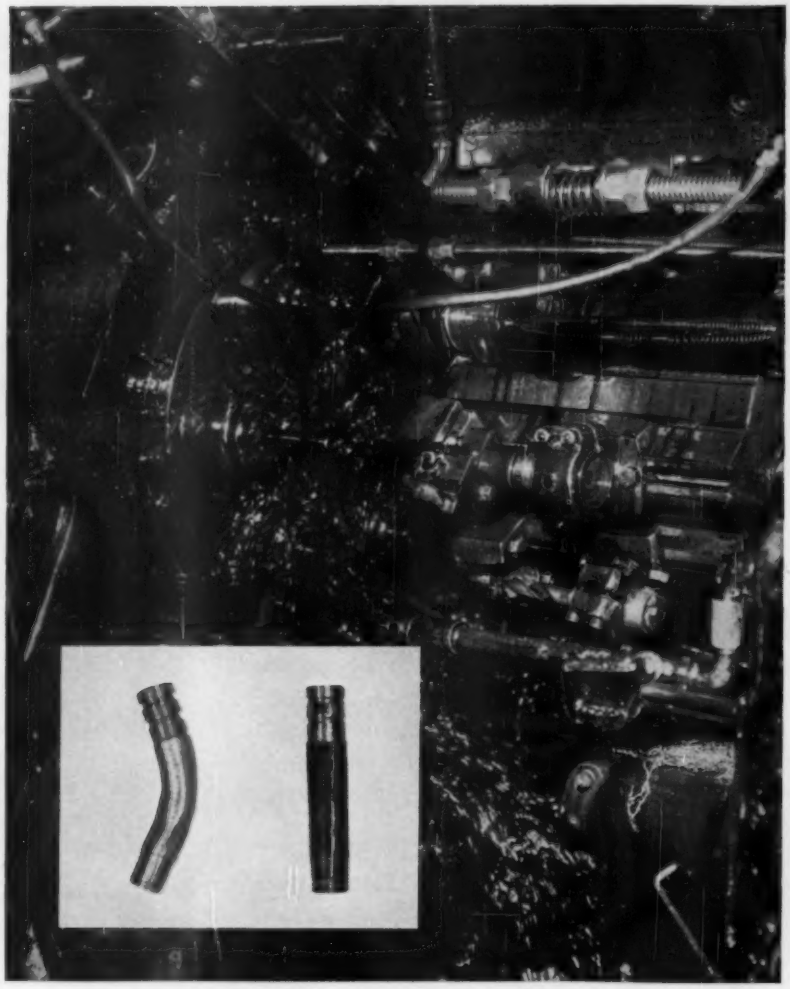
THE R. K. LEBLOND MACHINE TOOL COMPANY
Cincinnati 8, Ohio

LeBLOND of Cincinnati

World's Largest Builders of a Complete Line of Lathes for More Than 70 Years

"We get better finish and die threads last longer

...with Texaco Sultex Cutting Oils," says Cormier & Shaver Mfg. Co., Cleveland, Ohio



Machining carbon steel parts on New Britain multiple spindle automatics.

"We are a job shop," continues this customer, "and we machine many different types of steel. But our most demanding operation is the threading of automobile car heater parts from SAE 1010 carbon steel. We need a cutting oil that will provide a fine finish, and that will give us good die thread life. For several years now, *Texaco Sultex Cutting Oil A 2* has been doing an outstanding job for us."

There is a complete series of *Texaco Cutting Oils* to handle your toughest jobs in high speed cutting, broaching, threading and tapping. Let your Texaco Lubrication Engineer suggest the proper ones to help you do all your machining most efficiently, and at lowest cost. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

What's ahead ... in Metalworking

NEWS REPORT

June looks like a good month . . .

This is the best peacetime spring that the metalworking industries have ever had from the standpoint of goods produced.

May is continuing the pace of April. June looks like as good a month as May. After that, some sort of seasonal letdown is anticipated.

The summer months promise to be very good, however. Manufacturers feel that the fall season will see production on a scale close to that in the first half of the year.

Though capital goods makers have shipped more dollar volume than they have booked this year, their backlogs still are impressively large.

It appears probable that unless a pickup in new business occurs in the next 90 days, many producers of capital goods will cut back a bit their operating rates later in the year.

The materials handling equipment industry is an exception to the general trend. Its sales this year have shown a nice increase over last year, despite the fact that 1956 set a new record.

Implement outlook brighter . . .

Farm equipment industry is another area that shows promise. The unexpected rainfall in drought districts has raised crop estimates, and farmers will have bigger incomes than expected. Implement sales are bound to benefit.

Railroad car people are doing very well. Pullman-Standard delivered 1903 freight cars last month for the highest total since October 1953. Increased production is partly the result of greater ease in securing steel. Current backlogs of freight car builders are substantial.

Outlook is excellent in the contract tool and die field, though some spottiness is detected at Detroit. The year's dollar volume easily could go ahead of last year's.

Heavy competition in the appliance industry will call for extensive retooling for new models.

Guided missiles and electronics are also lucrative sources of tool and die business these days.

Steel mills are revising their ideas of 1957, with their sales sights set a little lower than they were. Users have been chewing up steel faster than they have been taking it in recently.

Atomic energy and missiles . . .

Metalworking is drawing a lot of support from the atomic energy and missiles industries. The two are so wrapped in secrecy, however, that a true measure of their influence is hard to determine. In both fields the influence will grow rather than shrink.

The aircraft people are very busy. Plane parts makers have a gratifying pileup of orders that will keep them running at a top rate all year.

The automobile industry at best has been a disappointment this year. It also has chosen to some extent to live partly off its inventories, a situation that can carry on for a limited time.

There is more spottiness in Metalworking than in several years. One manufacturer has lots of business; another is hungry for it.

Skilled shop men and engineers are just as hard to get as ever. Any unemployment is sufficiently low that it is causing very little if any distress.

Some companies have dropped down the amount of overtime work or have eliminated it entirely.

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AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	APR. Estimated	MAR. Preliminary	FEB. Revised	MAR. Year Ago
Total Index	**178**	**179**	**180**	**166**
Machinery	**154**	**154**		**146**
Electrical Machinery	**206**	**205**		**191**
Autos	**132**	**140**		**134**
Other Transportation	**382**	**366**		**310**
Other Metalworking	**144**	**144**		**137**

NEWS REPORT

What's ahead . . . in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	APRIL Estimated	MAR. Preliminary	FEB. Revised	MAR. Year Ago
Total Index	**152.0**	**151.7**	**151.5**	**143.5**
Metalworking Machinery	**175.0**	**174.9**	**164.3**	
Other Machinery exc. Electrical	**160.2**	**160.0**	**149.5**	
Electrical Machinery	**153.3**	**153.1**	**141.2**	
Fabricated Metal Products	**143.5**	**143.3**	**137.8**	

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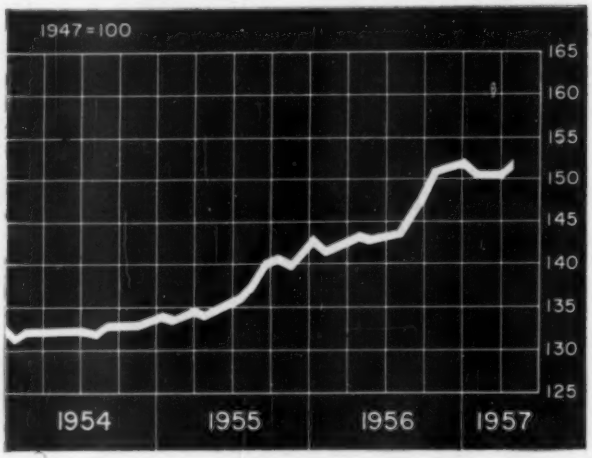


Putting some perspective into the '57 picture . . .

There is a decided tendency these days on the part of the public to regard automobile production as the barometer for all industry. And on the face of it, that industry has shown a decline since the halcyon year 1955.

In that so-called "freak" year, the automobile industry produced some 7.9-million cars—an all-time record. But it sold 500,000 fewer cars than it made. That started the 1956 model year off with dealers' lots jammed with unsold cars. Consequently, the automakers cut back their schedules to a more realistic 5.8-million units to give the dealers a chance to unload the '55s. Result is that the industry last year sold more cars than it produced—some 5.86 million.

The auto industry today is sadder but wiser. From here on out, production will be geared to sales. In the first quarter of this year, the auto people produced 1,777,000 cars, sold 1,490,000.

That leaves dealers with a normal stock of 37 days, compared with 44 days a year ago—a much healthier situation. And the outlook for the industry is very good, too. Experts estimate 1957 will wind up as a 6.2- to 6.5-million-car year—a good one on anybody's books.

Outlook for employment is very bright. In recent months, employment has been hovering around a highwater mark of 64 million, while unemployment has been dropping steadily. Job gains have been chalked up in both farm and non-farm employment for several consecutive months.

Personal income, bulwarked by record employment and rising wages, is at an all-time high rate of $337.5 billion a year. Gross National Product (total value of all U S goods and services) is hitting a record annual rate of $427-430 billion. And it shows no sign of tapering off.

WEEKLY BUSINESS INDICATORS

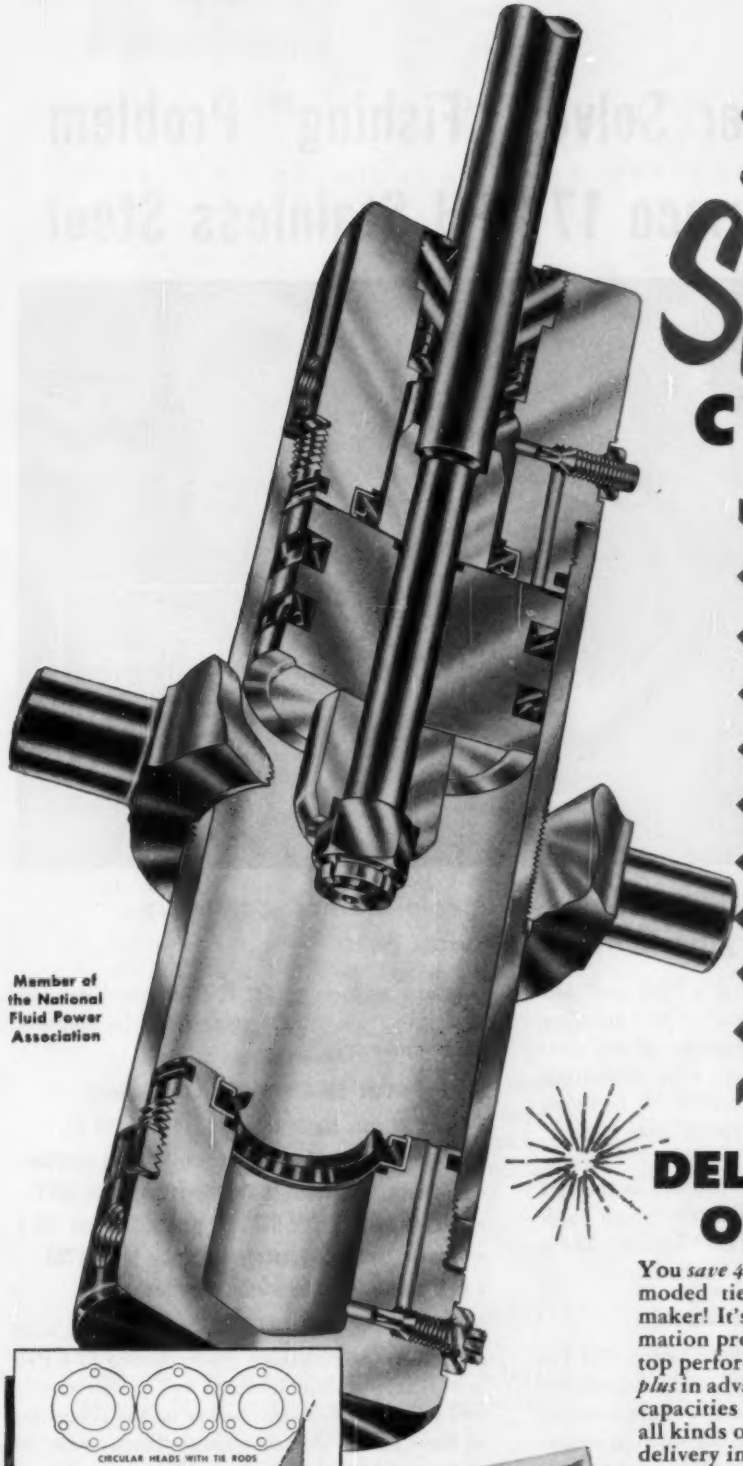
	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49=100)*	142.9	143.6	146.6
Steel ingot production (thousand tons)	2,240	2,226	2,343
Electric power output (million Kilowatt hours)	11,286	11,310	10,815
Production of automobiles and trucks	157,205	159,992	148,662
Engineering construction awards (Eng. News-Record, millions)	$385.3	$476.0	$557.7

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	284	290	299
Vacuum cleaners sales (thousands of units)	431	277	286
Washers sales (thousands of units)	320	331	406
Household electric ranges sales (thousands of units)	109	105	123
Radio production (thousands of units)	1,265	1,086	1,079
Television production (thousands of units)	465	450	576
Gear sales index (1947-49=100)	239.5	259.3	256.2
Foundry equipment new orders index (shipments, 1947-49=100)	188.4	117.9	169.0

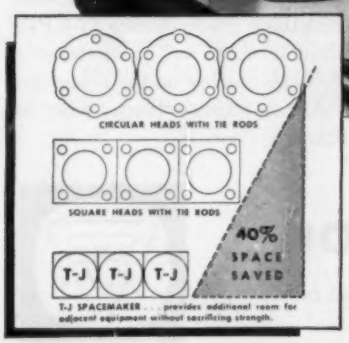
* Seasonally adjusted

all the EXTRAS are standard with T-J Spacemaker CYLINDERS



Member of the National Fluid Power Association

- **NEW** *exclusive* ingenious cushion designs . . . Super Cushion Flexible Seals for Air . . . New Self-Aligning Master Cushion for Oil.
- **STRONGER** than outmoded tie rod design, proven through actual tests. No tie rods to stretch.
- **SOLID STEEL HEADS** throughout the full line.
- **COMPACT DESIGN** eliminates tie rods, increasing the strength and reducing mounting space required, providing extra room for adjacent equipment.
- **HARD CHROME PLATED** body bores and piston rods . . . assure you of long trouble-free service. (Standard at no extra cost.)
- **METALLIC ROD SCRAPER,** not just a wiper, actually removes foreign matter from the rod.
- **PILOTED PACKING GLAND** with extra long bearing. Additional strength and support to the piston rod.
- **OIL** pressure to 750 p.s.i. AIR to 200 p.s.i.


CIRCULAR HEADS WITH TIE RODS
SQUARE HEADS WITH TIE RODS
40% SPACE SAVED
T-J
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T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

DELIVERY OFF THE SHELF!

You *save 40% space* when you switch from outmoded tie rod cylinders to the T-J Spacemaker! It's stronger, too! Fits right into automation programs in countless plants. Delivers top performance and dependability with a big *plus* in advanced features. Wide range of styles, capacities . . . reduces man-hours and costs in all kinds of push-pull-lift operations. Off-shelf delivery in 64,000 combinations!

NEW LITERATURE—Send today for new Catalog SM56 with complete engineering details on Spacemaker line. Write The Tomkins-Johnson Co., Jackson, Mich.

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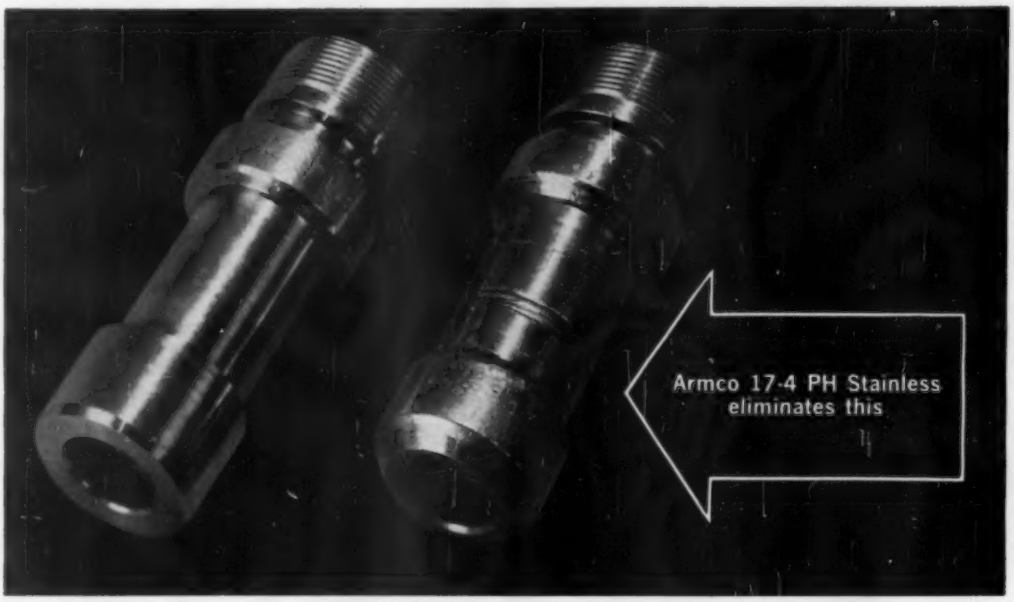
RIVETORS . . . AIR AND HYDRAULIC CYLINDERS . . . CUTTERS . . . CLINCHORS

Designer Solves "Fishing" Problem with Armco 17-4PH Stainless Steel



Unusual combination properties of special Armco Stainless assures satisfactory performance of vital part.

This problem was not landing a "big one" but designing a valve "fishing neck" to give unfailing performance in rugged underground oil well service. Formerly made of a high alloy nonferrous metal, the part couldn't withstand the battering and high stresses when grappling tools "fished" the valve to the surface.

Now made of Armco 17-4 PH Stainless, the part has the required corrosion resistance, high hardness and strength to assure good "fishing." And it eliminates costly delays in well operation.

Solution to Many Design Problems

This vital part is typical of how Armco 17-4 PH is being specified to improve product durability and performance in a wide variety of applications. Wherever parts are subject to corrosion in combination with high stresses, wear, abrasion or temperatures as high as 900 F, this special stainless steel gives you unusual opportunities to improve your products.

Here's what 17-4 PH Stainless offers:

- **Typical ultimate tensile strengths up to 200,000 psi**
- **Rockwell hardness of C43 in the fully hardened condition**
- **High mechanical properties at temperatures up to 900 F**
- **No distortion and scale-free heat treatment at only 900 F**
- **Corrosion resistance generally comparable to Type 302**
- **Good machining and fabricating properties**

Armco 17-4 PH Stainless is produced in bars, wire and billets. A companion grade, Armco 17-7 PH, is available in those forms as well as sheets, strip and plate. For full information on the properties of these special Armco Stainless Steels, write us at the address below.

ARMCO STEEL CORPORATION

1357 CURTIS STREET, MIDDLETOWN, OHIO

SHEFFIELD STEEL DIVISION • ARMCO DRAINAGE & METAL PRODUCTS, INC. • THE ARMCO INTERNATIONAL CORPORATION

American Machinist

MAGAZINE OF METALWORKING PRODUCTION · ESTABLISHED 1877

Best For Small Business Too

Small business occupies a unique position. It has legions of friends, ranging from local, state and national politicians to the American people in general who admire individual initiative and enterprise. It has no enemies, at least none that is publicly identifiable.

It is, in fact, the darling of Washington. Congress and the White House have long courted it through the Small Business Administration.

To be hard-headed about it . . .

one could easily explain away this popularity by saying that Small Business represents more votes than Big Business. And the public usually sides with the little fellow against the big. But that is not the whole story.

Our economic prosperity has been built on a solid foundation of little businesses, tens of thousands of them in Metalworking alone. Big businesses did not spring up from nowhere. They grew out of little businesses.

Despite the sensational success of massive corporations and the growing trend toward mergers, small business as such is seriously to be reckoned with. If it were to go to pot tomorrow, our prosperity would vanish.

That is why it is . . .

so important to nourish small business and to do everything possible to make it flourish.

If it is necessary for a man heading a big corporation to be progressive and to possess vision, courage and initiative, it is equally essential for the owner or manager of a small business to have the same admirable qualities.

What the big company does on a large scale, the little company must do equally well on a small scale. That is, it must do it equally well if it intends to survive and to prosper.

"Old-fashioned methods of management and administration are hampering the development of many small firms," Wendell B Barnes, administrator of the Small Business Administration, recently told members of the National Machine Tool Builders' Association.

"All of our programs of assistance to small firms have the major objective of helping them to modernize and improve, to increase their efficiency or to expand. It makes no sense anymore for a small firm to try to struggle along with outmoded machinery and equipment, with obsolete processes and materials."

With a few choice sentences . . .

Mr Barnes has succeeded in stating what ails small business and what the remedy is. Every operator of a small metalworking company should take heed of his words.

Small business must keep up with the fast-moving times if it wishes to hold its competitive position and to grow. The best thing that can happen is for it to dedicate itself to the proposition that modern scientific management, intelligent forward planning and careful, continuing investment in cost-saving production methods are sound policy for it as well as for the big boys.

Burnham Finney EDITOR

accurate **CINCINNATI**

shearing from **20 GAUGE SHEETS** to **5/16" PLATE**

...with ONE knife setting

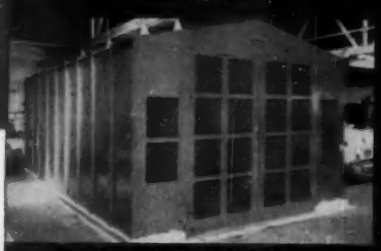
...SPEEDS PRODUCTION

Here 20 gauge to $\frac{5}{16}$" plate is sheared with no change of knife clearance—a time saving and production increasing feature.

The Binks Manufacturing Company say this Cincinnati Shear is a very accurate machine and a most profitable investment.

Write Department A for Shear Catalog S-7R. We also suggest you contact our Application Engineering Department for information on your shearing problems.

Water cooling tower



Dry auto spray booth

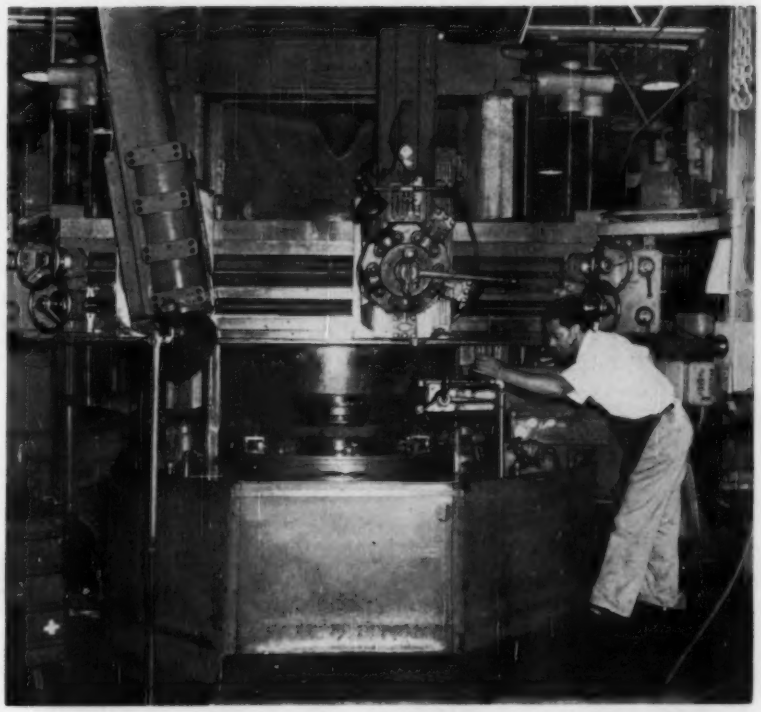
Water wash spray booth

Photos courtesy Binks Manufacturing Company, Chicago, Illinois

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS · SHEARS · PRESS BRAKES

American Machinist



Horizontal groove is cut . . . in type 410 stainless at 620 sfpm. The groove must be held to a tolerance of 0.001 in. on width and a 63 mu-in.-rms finish. A C-8 carbide tool (⅝ round insert) is used with a feed of 0.016 ipr

the "GIVE 'EM-HELL" approach to stainless...

If you forget about tool life you can machine stainless at high speeds and invariably get better finish at lower cost

ART QUINLAN,
Supervisor,
Machine Planning,

RYAN
AERONAUTICAL CO,
SAN DIEGO

Standard machining speeds for stainless are based on the idea of getting maximum life from the tool. We forget that tool cost is often not the major element in the cost of operation. At Ryan we are now finishing stainless at speeds up to 1000 sfpm and doing most of our roughing at 500 sfpm.

It took us a while to shake loose from the cautious approach to stainless. It took even longer to convince the machinists not to baby these materials.

To tackle high-speed machining of stainless requires good machine condition, proper tool grinding, rigidity of both cutting tool and fixture, and adequate horsepower. All these factors are present in any cutting operation with carbide, but they become more critical in machining stainless at high speeds.

For straight roughing at normal speeds, the best results are obtained with high rake angles and the tougher grades of carbide. This method has disadvantages, notably poor chip condition and lessened tool life. Proper chipbreaker grinding and careful honing of the cutting edge will help. For heavy cuts, roughing grades of straight tungsten carbide in the 300 series and steel-cutting grades in the 400 series work well. When interrupted cuts are made, the rake angles must be reduced propor-

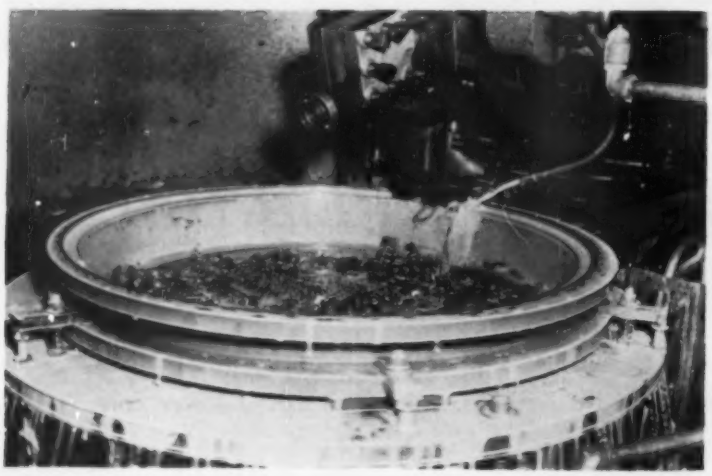
the "GIVE 'EM HELL" approach to stainless . . .

tionately to the amount of shock involved. This, coupled with a negative-rake shear type of tool, will work in some cases.

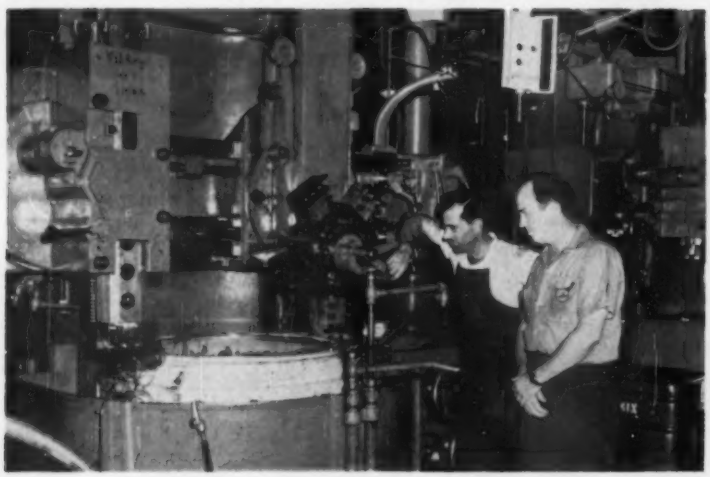
Our departure from standard practice into high-speed machining started when we had a problem in turning large-diameter jet-engine parts. These parts could not be anchored rigidly and they required excessive machining time. We converted to insert and throwaway toolholders and installed specialized holding fixtures on the machines.

By experimenting, we found that using negative rakes in combination with the absence of grinding

Type 410 is faced at 750 sfpm . . . on this 35-in.-dia forging. The type C-7 carbide is a 15°-lead-angle insert tool with a 0.125-in. corner radius. Feed is 0.008 ipr



A bore 4½ in. long . . . in large forging of type 410 stainless is typical of costs. When the part was bored at 250 sfpm and 0.008-ipr feed, the tool cost per piece was 4¢. Now the C-7 carbide insert with a 30° lead angle and a 0.090-in. radius is run at 650 sfpm, 0.020-ipr feed, and 0.060-in. depth of cut. Tool cost is now 24¢ per piece (compared with previous 4¢), but there is a saving in machine time of 18 min per part at approximately 11¢ per minute



Simultaneous cuts on Type 321 . . . stainless at 800 sfpm include one boring and one facing operation. Feeds on the two cuts are coordinated so the operator can disengage one while the other cut is finishing. The C-3 carbide inserts have a 0.125-in. radius. This pair of operations, originally requiring nearly 20 min, is now completed in 2 min

and brazing strains in the holding fixtures allowed high surface speeds with the hardest carbide grades. This led us to our present standards of 500 to 1000 sfpm for turning.

Such speeds have been achieved on the free-machining stainless steels, but substantial increase in speeds is possible on all the high-temperature alloys. At the higher speeds excellent finishes are obtained. Lubricant in the cutting fluid becomes a minor factor and chemical coolants, such as Dy-Pral, Lusol, and Trim, provide better wetting and more efficient cooling.

ALSO WORKS FOR MILLING

This same approach also works in carbide milling. Negative-rake carbide-insert cutters work well at speeds equal to or above those used for turning. If we are forced to reduce the speed because of machine capacity or cutting-tool diameters, then we find positive rake angles work better if the cutting tools are properly ground and honed. This is contrary to accepted milling practice, but works..

Other experience with milling is more conventional. We get better results with climb cutting, especially on the abrasive stainless steels. A high chip load per tooth gives a longer cutter life. Balanced flywheels also lengthen cutter life.

An interesting sidelight on the adoption of high-speed machining for stainless has been its effect on the operators. The increased tempo carries over into other operations. For instance, setup on the simultaneous finish cuts on 321 stainless took 40 min. When the machining speeds were stepped up the operators themselves reduced the setup time to 18 min.

In short, we find that if you concentrate on maximum feeds and speeds for stainless, increased production, personnel efficiency, and machine availability will result.

On-the-Job Balancing . . .

. . . is possible with portable machine developed by employee at naval shipyard

JOSE ARZAGA

A portable balancer that accurately picks up vibrations and locates dynamic unbalance under actual working conditions is being used at the San Francisco, Calif, Naval Shipyard. Designed by shop mechanic Tom Lane, the machine is mounted on wheels and can be rolled to the job and set up to check and balance equipment. Corrections for unbalance can be made directly, except where accessibility to the equipment limits the application of corrective weights.

Components include a modified Gisholt 3-S machine cabinet, pickups, and strobe light. Two speed-adjustment dials, designed to increase the operating range from 2000 rpm to 5000 rpm, have been added to the cabinet.

In use, as when checking a motor that has been rejected for excessive vibration, the pickups are placed at a convenient position—isolated from the job and on rubber mountings—and the pickup wire is attached directly to the job. The motor being checked is then energized, and under actual operating conditions the balance-machine operator adjusts the filter network on his machine to correspond with the rotational frequency of the motor. The strobe light is used to obtain the angle of unbalance.

Official US Navy Photograph

Balancing equipment on the spot makes for superior work, Naval Shipyard officials say. According to the Shipyard newspaper, the Drydocker, about $10,700 a year will be saved at that activity through application of the balancer.

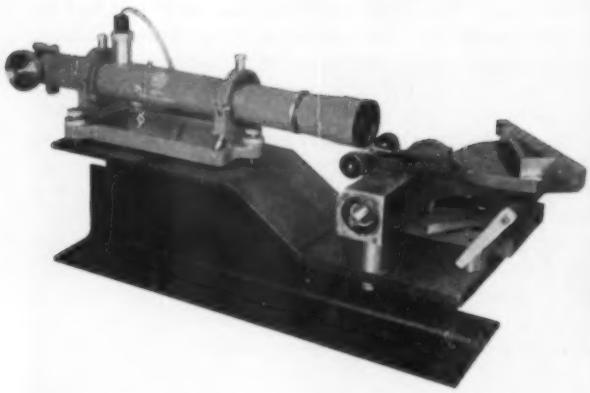


FIG. 1—Hand-powered prototype gear cutter used angle blocks and an auto-collimator to lay off angles, but was able to cut sector gears accurate to within ± 5 sec of arc

FIG. 2—Power-driven gear cutter has improved gear-blank clamping and indexing methods. Angle blocks permitted an accuracy to ± 3 sec of arc, by careful calibration and wringing

With incremental cutting...

Missile gears are held to ± 5 seconds

Here are the basic concepts that produced sector gears accurate enough to lay off angles in missile-guidance control systems. No suitable methods existed to cut and calibrate the gears before this research was undertaken. Here you get the benefit of Northrop's experience in choosing a gear-cutting method, preparing the blank, and inspecting the product

ROLAND E GAGON, senior engineer, NORTHROP AIRCRAFT, INC

During the early postwar years it became obvious that known gear accuracies were completely inadequate for the needs of missile-guidance and control systems. Gear manufacturers were not equipped to provide the required accuracy. Hence, it was necessary for our research and development organization to produce the gears. This meant entering an unfamiliar field, and at the same time advancing the art of gear manufacture.

For the guidance system in the SM-62 Snark intercontinental missile, the proposed operational system required gearing with an angular accuracy within ± ½ sec. of arc. Early experimental systems were then using angle-generating gear trains with an accuracy of only one-sixth that required in the next stage of guidance development.

After study, it was decided to use gearing of a high-reduction worm type. The maximum required accuracy was to be developed in the last element of the gear train—a sector gear of relatively short radius. The cutting would be done incrementally rather than by generation.

The problem of accurate generation of angles had been under study at Northrop since early in 1948. This fact influenced our decision about type of gearing, because:

1. Normal generating methods require rotation of the gear blank,

which involves clearances and lubricant film with attendant potential inaccuracies.

2. Generating requires that the gear blank be driven by gears which are more accurate than that which is to be cut. Because the need was to cut a gear better than any then obtainable, this approach appeared to hold no promise.

3. Greater accuracies had been attained with screw threads than with gears. By the Northrop approach the cutter embodied the simple geometry of a thread, as does the driving worm with which the gear is used.

4. Previous Northrop experience in angle generation had utilized a precision leadscrew. As a result of this experience a leadscrew interferometer had been developed to check lead error on worms to several millionths of an inch.

5. The high reduction inherent in worm-type gearing made for a simpler tooth geometry, and thus actually made the incremental cutting concept possible.

EXPERIMENTAL MACHINE

Based on these decisions, a program was initiated to design and fabricate experimental tooling to investigate the feasibility of cutting a 5-sec gear.

The first gear cutter, Fig. 1, was a small, hand-powered device that fits comfortably on a desk top. This rather insignificant-looking device successfully produced a gear within the specified angular accuracy of ± 5 sec. of arc.

From this experience we built the small power-driven gear cutter shown in Fig. 2. Improvements were made in respect to the gear-blank clamping and indexing methods, and to compatibility in pitch radius with actual design requirements of a proposed airborne unit. The device also incorporated a limited amount of automatic control for motor reversal plus several safety features not necessary in the prototype.

The gear cutter in this form was used to provide all necessary precision gearing for several experimental airborne guidance systems, and is still used to produce gears for the Northrop guidance program. Also, a larger and more automatic unit has been developed for use by persons with less skill.

Unlike the conventional method of cutting gear teeth, the gear cutter has no gear train between the gear blank and the cutter. The gear blank is located at each cutting position by precision optical means and is then clamped solidly before the cut is taken. Each indexing movement corresponds to the angle of one tooth on the gear. With the blank clamped in position, the cutter traverses across the gear face, producing a very light finishing cut not more than 0.001 in. deep and at the very slow cutting speed of not more than 2 sfpm. The cutter is advanced by an accurate leadscrew, which is integral with the cutter and of the same pitch as the cutter. Each pass removes metal corresponding to the form of a basic rack. This series of successive cuts at each tooth position forms a series of small steps which ultimately results in a close approximation of the involute form.

Departure from a true involute may prove upsetting to those who work intimately with gearing problems. In our application the only real criterion of success or failure is ability of the gear to lay off accurate angles.

Long-range missile and guidance control systems require gears of unusual accuracy. Missile control is influenced by angular shaft movement. A very small error in angle may produce a very large lateral or longitudinal error in trajectory.

In the fabrication and assembly of the gear cutter, the utmost care went into fits and joints, because no strains could be tolerated in the machine. Much use was made of lapping techniques. Each stage of the assembly was checked for accuracy of part relationship by optical means with frequent disassembly and recheck if any question of accuracy existed.

HOW ANGLES WERE OBTAINED

In early use of the gear cutter only one method was available to measure and lay off the relatively large angles for gear-tooth increments. The method involved using angle gage blocks to build up the required angles. Once the desired angle combination had been built up and allowed to stabilize, it was placed against accurately ground and lapped pins on a support table. The table was rigidly attached to the gear. A microptic autocollimator was then used to get a reflection off the face of the blocks. Such a setup can be seen in Fig 2.

During the experimental work, a method was developed for calibrating the errors in the angle gage blocks which permitted their accuracy to be known to within 1 sec of arc. However, it was recognized that improper wringing of the blocks could never be fully eliminated. For this reason, the gage blocks were only considered

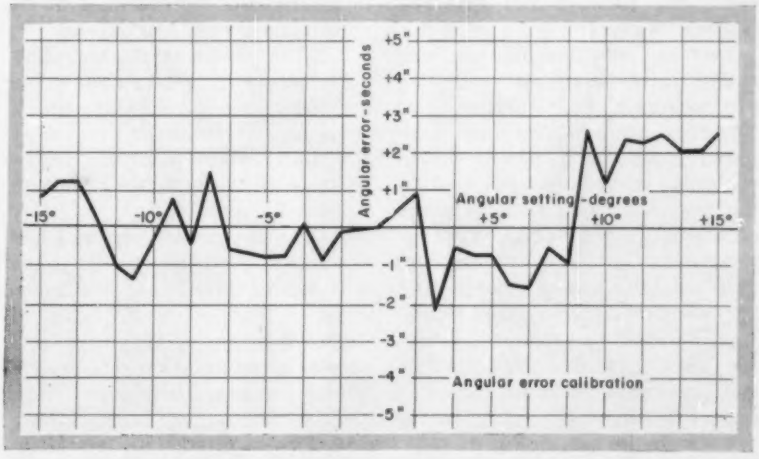
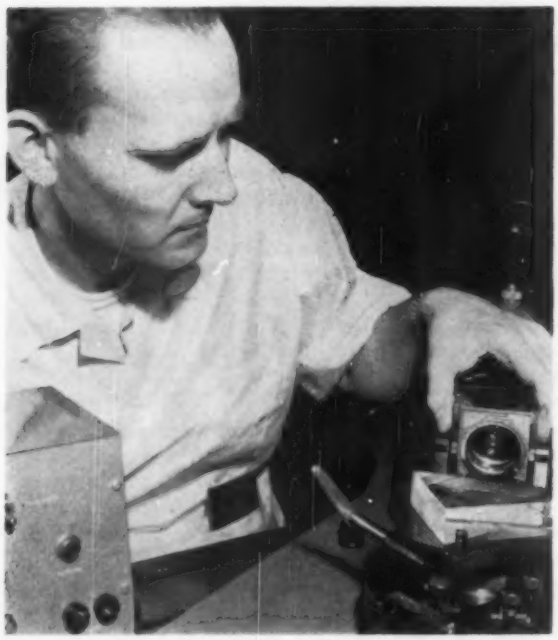


FIG 3—Angular-error calibration of a sector gear cut on setup shown in Fig. 2



ANGLES PRODUCED WITH GLASS ANGLE BLOCKS AND WEDGE

Required Angle	Angle Block & Refraction Wedge Combination
0°	Parallel
0°50′	Parallel +50′ wedge
1°40′	Parallel +150′ wedge −50′ wedge
2°30′	Parallel +150′ wedge
3°20′	Parallel +150′ wedge +50′ wedge
4°10′	−150′ wedge −50′ wedge +7°30′ block
5°	−150′ wedge +7°30′ block
5°50′	−150′ wedge +50′ wedge +7°30′ block
6°40′	−50′ wedge +7°30′ block
7°30′	7°30′ block
8°20′	7°30′ block +50′ wedge
9°10′	7°30′ block +150′ wedge +50′ wedge
10°	7°30′ block +150′ wedge
10°50′	7°30′ block +150′ wedge +50′ wedge
11°40′	−150′ wedge −50′ wedge +15° block
12°30′	−150′ wedge +15° block

FIG. 4—Glass angle blocks were produced in the Northrop optical laboratory to the required angle with error less than 0.5 sec of arc

as an interim measure even though their use did permit the cutting of a number of successful gears ranging in accuracy down to ± 3 sec. of arc. An error plot of one such sector gear is shown in Fig 3.

Replacement of gage blocks with other angle-generating methods was evolutionary. The first major forward step was the reduction of the number of gage blocks required by introducing refraction wedges into the collimator beam. Whereas it had previously required a tedious buildup of blocks for each angle, this method allowed full coverage of a 90° sector with the use of only seven angle combinations, one parallel and two refracting wedges.

This line of thinking was extended to eliminate any necessity for wringing gage blocks. The Northrop optical laboratory prepared glass angle blocks which could be ground and polished to the required angle with an error of less than 0.5 sec. of arc. Two results were secured: (1) removal of a potential source of error and (2) a significant reduction in the time required to produce a precision gear. Up to this point the time per gear averaged 20 hr, including final calibration. The glass blocks are shown in use in Fig 4.

One factor which weighed heavily upon the end-product accuracy was blank preparation, and particularly the center mounting hole. It was decided to make this hole conical, thus insuring that it would be used about the same rotational center as had previously been used in cutting.

Preparation of a blank for cutting originally called for considerable hand work and highly skilled technicians to perform the final stages:

A typical sequence in arriving at a finished blank included:

1. Rough machine to oversize dimensions.

2. Lap one gear face to bring it to a flatness of 0.00002 in. over its approximate 6-in. length.

3. Grind the conical mounting bore, accurately referenced to the previously lapped surface, and a rough grind of the OD.

4. Lap second face into parallelism with the first face to within 0.00005 in.

5. Lap the conical bore to bring the axis of the taper normal to the first lapped face. This had to be done so that, when the blank is mounted by the conical bore on a special grinding arbor, the runout across the gear tooth face is less than 0.0002 in.

6. Finish grind OD, establishing concentricity of the conical mounting bore and surface on which teeth are to be generated.

7. Recheck for flatness and parallelism of faces.

Refinements now permit much of the foregoing to be done on production-type lapping machines. Blank preparation has ceased to be the time-consuming operation it once was.

Thought has been given to the desirability, from a production standpoint, of replacing the conical bore with a cylindrical hole. It is true that advances have occurred in hole grinding since our decision was made to use the taper bore. But the extreme repeatability of centering and ability to compensate for wear inherent in the conical form justify, for us, the added complexity in blank preparation.

GEAR-CUTTING PROCEDURE

With accuracy thus built into the cutting machine and the gear blank, the generating of the gear teeth requires only the normal precision expected of any instrument technician. After the blank is assembled into the gear cutter a cycle would be:

1. Select the proper angle and refraction wedge combination to allow the cutter to mark, just visibly, either edge of the sector periphery when the gear sector is

indexed by auto-collimation and the cutter has been hand driven to a point of tangency.

2. Tighten the nut which causes the conical clamping shaft to define the rotational center of the blank.

3. Lock the adjusting clamp to a cylindrical member which supports the gage-block table and make fine indexing adjustments.

4. Lock gear blank into final cutting position with locking plungers which bear near the cutting face. This method of clamping eliminates chatter which might be induced by the cutter and also minimizes any strains.

5. Verify accuracy of blank positioning by repeated placement of angle blocks against table pins and rechecking through the auto-collimator.

6. Make the first cut. The cutter traverse is started by a manual switch, coming to a stop automatically when the cut is complete. For maximum safety of the blank it is necessary that it be unlocked and swung free of the cutter path before the cutter can be returned, thus eliminating possible damage from chips.

7. With the sector in the clear and cutter returned and cleaned, a second cutting angle can be set up. The accuracy of the machine is well demonstrated here in that, if desired, it is possible to reverse the angle gage block and wedge combination to achieve the opposite angle and cut from each end toward the middle, coming to a common meeting point in the center of the gear face with no degradation of accuracy. This circumstance reduces the number of angle combinations to one half that which would be required if the cutting was done progressively from one end to the other.

8. Proceed in this manner, cutting from each end alternately through the required number of 50-min arc steps, to arrive at the final cut when auto-collimation is accomplished off a parallel block. Upon completion of the cutting operations, the gear face is carefully hand stoned to remove any burrs, in preparation for a short run in with a lapping worm. Running-in serves somewhat to refine the teeth surfaces prior to calibration.

Lapping is done with a thin mixture of kerosene and a commercially available metal polish. The operation is continued until there is full-range uniform mating.

The lapping operation is done on the spindle and bearing combination that is subsequently used in calibration. Here again, success in achieving the required accuracy of calibration is directly proportional to the care exercised in the fabrication and assembly of the lapping-calibration support fixture. The same basic lapping and fitting techniques, mentioned with reference to the gear cutter, were applied to guarantee repeatability of alignment after disassembly and reassembly for calibration, utilizing a master calibration worm as a replacement for the lapping worm.

INSPECTION EQUIPMENT

Early in design activity on the gear cutter, Northrop recognized the need for adequate inspection means, if and when the 5-sec. gear became a reality. The search led to purchase of a British microptic table, Fig 5, which has been used successfully, in conjunction with other supporting optical and mechanical equipment, to calibrate all the sector gears required for experimental prototype and pilot production runs.

The table, as purchased, was provided with an accuracy calibration indicating that it, within itself, contained angular positioning errors ranging as high as 3.6 sec. No problem was presented because the errors were known and could be accounted for in calibration. In addition, the table was found to be most accurate over a part of its full range and consequently this portion was always used.

As experience was gained in the use of the microptic table and its associated auto-collimator, several factors emerged as being of primary importance in an accurate calibration.

It was found necessary to establish a temperature stability condition in all equipment. This was accomplished by allowing the full setup to soak at a near constant temperature for 3 to 4 hr, and requiring that for the last hour there be no perceptible change in temperature.

As might be expected, some of the gears failed to pass the error specification of ±5 sec. and were consequently considered as scrap. By study of the calibration curves of 31 rejected sectors, a method was evolved and automatic equip-

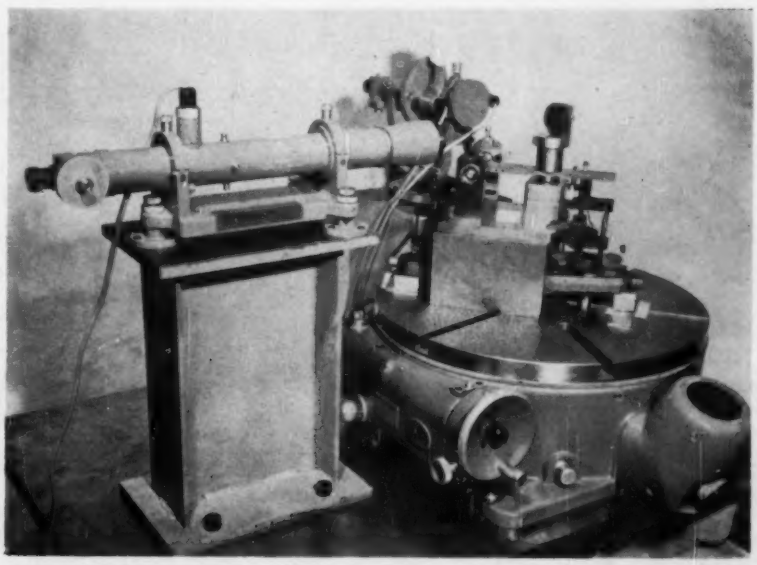


FIG. 5—All sector gears are now inspected on a microptic table and supporting optical and mechanical calibrating equipment

ment produced to perform an operation termed "preferential lapping." This method permits a variable degree of lapping over the gear face, emphasizing those areas shown to have excess material by the calibration curve. The machine also feathers the heavily lapped areas into the unlapped surfaces by means of constantly varying the extent of gear face coverage with each traverse. Through this method 24 of the 31 sectors were saved.

All gears cut thus far have been made from a high-carbon resulphurized steel obtained from the Jorgensen Steel Co under the trade name of "Speed Treat." This steel was selected because it has the physical properties of higher alloyed steels but is more easily machined, providing a minimum of burring and tearing tendencies. There is every reason to believe that gears of the same precision can be cut in a variety of materials.

Aluminum sector gears have been successfully cut in experimental quantities in the same basic manner as with steel. Important differences were: (1) the cutter had to be kept sharp to prevent tearing, (2) setting up required more care because of susceptibility of the softer metal to local damage from impact loads, and (3) filtered kerosene was used instead of the lard oil used for steel.

Lapping of aluminum gears is likewise done in exactly the same way as for steel parts. The lapping rate, however, is much higher and, for this reason, more care is required. The preferential lapping correction factor for steel is one second of arc for each minute of lapping time per tooth, whereas that of aluminum is 4 seconds of arc per minute of time per tooth.

The material used was 24ST4 aluminum, processed for maximum dimensional stability by methods developed at the Massachusetts Institute of Technology. The desirability of the MIT processing methods had been thoroughly demonstrated earlier.

WEAR OF ALUMINUM SECTORS

One of the factors most in question regarding actual use of the aluminum sector in an operating airborne system had to do with the possibility of accuracy degradation as a result of wear rate. To evaluate this potential drawback, two of the specimen aluminum sectors were subjected to a life expectancy test, after having the teeth of one gear nickel-plated to a thickness of 0.0001 to 0.0002 in. The plating operation resulted in an error increase of less than 1 arc second. To speed up the rate of testing, the gears were driven at approximately 35 times their normal speed. After 60 hr of continuous driving, which was comparable to approximately 2,200 hr of normal operation, the plated sector showed an error change of 4.3 sec of arc, or roughly a 2 to 1 advantage for the plating.

This testing served to prove conclusively the feasibility of using aluminum precision sectors either plated or unplated.

Fig 6 shows comparisons of initial calibration with that observed after 60 hr of running. It is important to realize that these plots are calibrations of the full assembly on which the gears are used, and include in their error the effect of axes lack of orthoganality, errors in the input worm, and bearing errors.

Even though present requirements at Northrop require only the use of a sector gear it was realized early in the program that full exploitation of the potential required the cutting of a full gear.

A full gear has been cut in aluminum which, although not yet fully lapped or calibrated, shows promise of meeting the ± 5 sec. requirement.

Although these ultra-precise gears have only been produced to one pitch radius and applied to one specific guidance problem, there is every reason to believe that the basic concept is fully flexible and can meet the requirements of a variety of future needs.

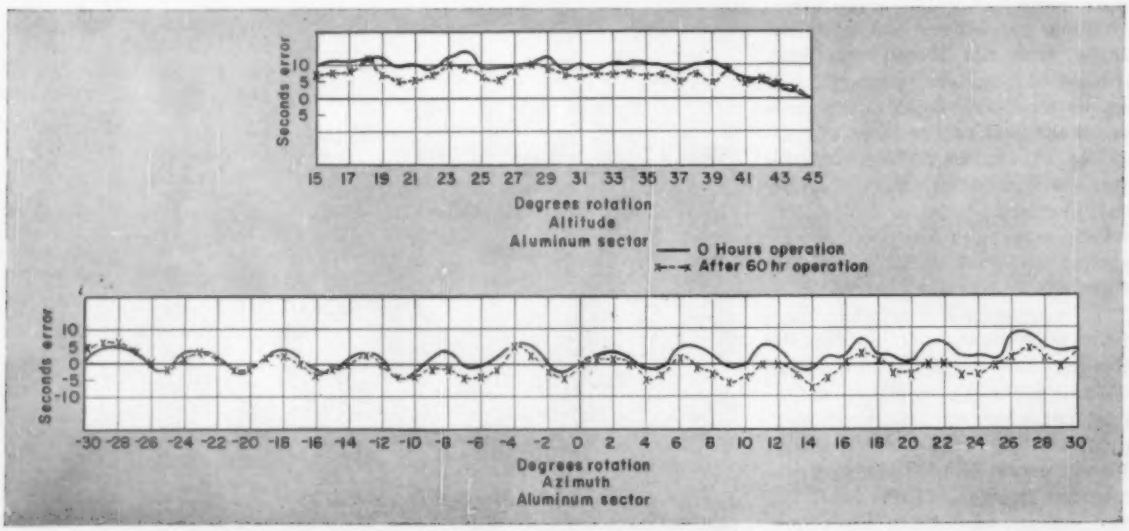


FIG. 6—Aluminum sector gears, nickel plated and unplated, were tested for periods up to 60 hr in the missile assembly with wear, or error increase, within tolerance

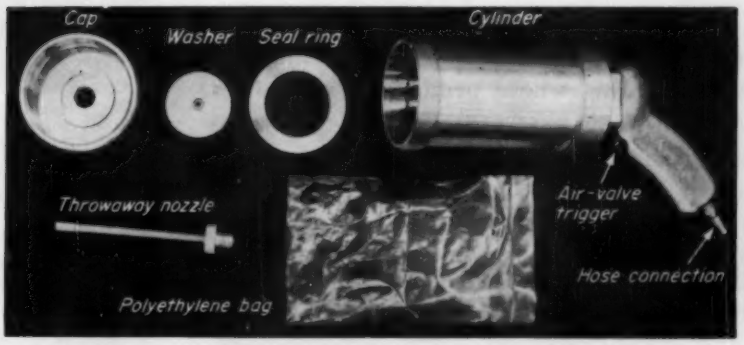
Potting of electrical connectors plays an important part in preservation of wiring in aircraft. Process prevents seepage of condensation to the solder joints of the connectors, that would otherwise cause corrosion and eventual short circuit. The potting room, where process takes place, is actually two rooms both temperature and humidity controlled, enclosed to maintain a relatively dust-free condition. Cleaning and setup room shown here, receives the connectors first after wiring has been completed. Here they are cleaned in tanks (background) with a solution of Inhibisol, prior to mold installation. Molds are arranged and clamped onto the connectors and then strapped to portable rack tables. Teflon is used to make the molds because of its non-adhesive properties in relation to the potting compound

Revamped Potting Process Molds Higher Quality Parts

GOSTA WERNBERG, assistant editor

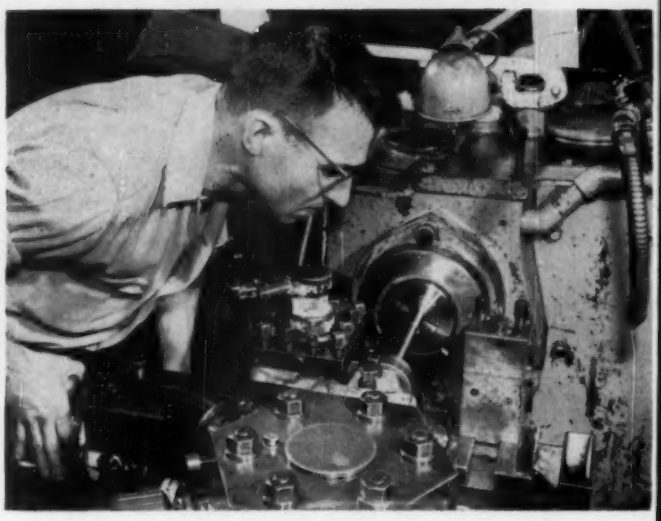
Recent process for potting electrical connectors uses Teflon molds, improved assembly techniques, and a modified injection gun that needs no cleaning. Process was developed by the Manufacturing and Engineering division of the Grumman Aircraft Engineering Corp. Though molding of rubber compound around parts and wires is not new, this method is unique because of its simplicity. Prior use of mechanical covers and straps relieved the stress on the solder joints but offered little protection against condensation.

In the second room base compound and accelerator are joined in one container whereupon it is placed in a commercial paint shaker, allowing 5 min agitating time. The injection gun, shown in operation, loaded with compound, is used to fill molds. Molds are then cured 10-12 hrs at 75 F (room temp) and 50% humidity. At the end of that period, molds are stripped and potted assemblies receive an accelerated cure of 125 F in the oven for 2 hrs. Rack is then removed from oven and allowed to stand for 15-20 min at room temperature before connectors are used. A refrigerator is maintained at –10 F for storage of compound after mixing. Compound, thus kept, remains pliable for about 36 hrs



Compound injection gun, an exclusive Grumman design, is used for injecting potting compound into molds. Design is an improved version of several previously designed guns that employed a cardboard container to hold compound. Disadvantage of the cardboard-container gun was its tendency to leak compound into the cylinder, creating a major cleaning operation. It also had a metal-tube nozzle, presenting a second cleaning problem. New gun has a disposable plastic bag sealed at one end. Bag, loaded with compound, is dropped into cylinder. Seal-ring is then seated on cylinder shoulder, allowing bag to protrude through the hole. Bag opening is spread evenly around seal-ring hole and washer inserted to seal bag. Only the small hole in the center of the washer is open. Plastic throwaway-nozzle, through pressure exerted by the cap, seats against hole in washer. Consequently, air never contacts compound

Tool life is good . . .
. . . with ceramics even when machining conditions are not ideal. Here a 7½-hp lathe built in 1942 is used to machine a 4¼-in.-dia bar of annealed 4140 that is chucked in the headstock, with a live center in the tailstock to gain as much rigidity as possible. Tool is a ½-in.-dia round RT4 Sintox insert in a mechanical holder with a −6° rake angle. Speed is 825 sfm, depth of cut 0.100 in., and feed 0.0038 ipr. Surface finish is 63 mu-in. rms

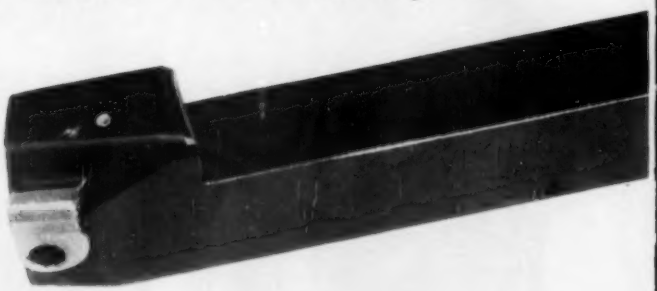


Two oxide cutting tools . . .
. . . are used in this setup for machining tool-steel sleeves hardened to R_c 52-55. A Sintox insert in a mechanical holder turns the OD from 1⅛ to 1.060-in. dia and a Wendt-Sonis tool in the back toolpost chamfers one end. Cutting speed is 436 sfm, turning feed is 0.0065 ipr, depth of cut about 0.032 in. Good finishes are obtained with a sulfur-base coolant, used mainly to protect the work

CERAMIC TOOLS *pay off on short runs, too*

GEORGE H DE GROAT, associate editor

Increased tool life is the reason for switching to ceramic tools at North American Aviation, Inc, where production quantities may run from 2 to 600 parts. Here's a description of how these tools are used advantageously in the company's Main Machine Shop



Mechanical holders . . .
. . . with a 15° lead angle prevent shock loading at the cutting edge of a tool at the start of a cut. Negative rakes are used in all setups. Here a triangular Diamonite oxide insert is held in a Viking toolholder with a carbide chipbreaker and anvil

According to the best advice, ceramic tools perform well only at high speeds and on the latest, most rigid equipment. But what if the tools don't know they are being used on machines not ideally suited for the job? The answer, at least in one case, is that good results can be had with oxide tools operated at relatively low speeds in standard machines of average condition.

This machining is being done in the Main Machine Shop at North American Aviation, Inc, Columbus, Ohio, where rush orders are frequently set up in open machines of any type rather than held for the most efficient equipment. Of course, these production machines are in good shape, but they are not the extremely rigid, high-powered equipment usually recommended as ideal for ceramic tools. When parts are urgently needed and production runs are as few as two pieces—runs are sometimes 200 pieces, but seldom more than 600—expediency takes precedence over efficiency. Besides, considerable efficiency has been picked up by switching from carbide to ceramic tools for some of these jobs.

The big advantage has been increased tool life. On one job oxide tools, running at the same speeds

and feeds as carbides because of machine limitations, lasted three times as long. A second advantage gained on this job was the excellent surface finish, which eliminated a rough-grinding operation previously performed.

In another instance, tool life jumped from 2 or 3 pieces with carbide to 270 with ceramics. Here parts were slightly out of round from heat treating. Previously carbides were run at 920 rpm with a feed of 0.004 to 0.0065 ipr and a depth of cut of 0.047 in. These tips burned and fractured almost immediately. At the same depth of cut and a slightly greater feed (0.010 ipr), the ceramic tools were run at 1480 rpm with excellent results.

TOOL GEOMETRY AND RIGIDITY IMPORTANT

Although these jobs are run in ordinary production-line machines, chatter and vibration are avoided. Tools are always maintained at dead center on the work, which is held rigidly between centers or in a collet at the headstock with a live center in the tailstock. Various mechanical toolholders are used, with as much of the insert supported as possible. In general the critical point as far as rigidity is concerned is considered to be between the insert and the holder. Because resistance to impact is low with the oxide tools, a second cut is never made to a shoulder formed by a previous cut.

Disposable inserts made by Diamonite Products Mfg Co, Sintox Corp, Wendt-Sonis Co, and American Lava Corp are used in a variety of mechanical holders that provide negative cutting angles. Typical is a ½-in.-square Sintox insert, ¾-in. thick, with a 3/64-in. nose radius. This tool is used in a Sintox holder with a 15° lead angle set up to provide –5° rake angles. Another is a triangular Diamonite insert, 3/16 in. thick, used in a Viking holder with a 15° lead angle. Grade A-652 Wendt-Sonis inserts ½ in. square by 3/16 in. thick are used in similar mechanical holders.

In most cases no coolant is used. However, to protect the work (rather than the tool), eliminate chip welding or work hardening, or improve surface finish, a sulfur-base oil coolant is occasionally employed, depending upon the material being machined. Generous nose radii are used, and tools lead into the work with a 15° side-cutting-edge angle to prevent shock loading at the cutting edge at the start of a cut.

Although it is well known here that higher production rates are possible with speeds at least 50% greater than those used with carbide tools, this particular advantage is secondary to the long life achieved with oxide tools. For the same reason, feeds and depths of cut are kept within reason; no attempt is made to increase machining rates by increasing the rate of metal removal.

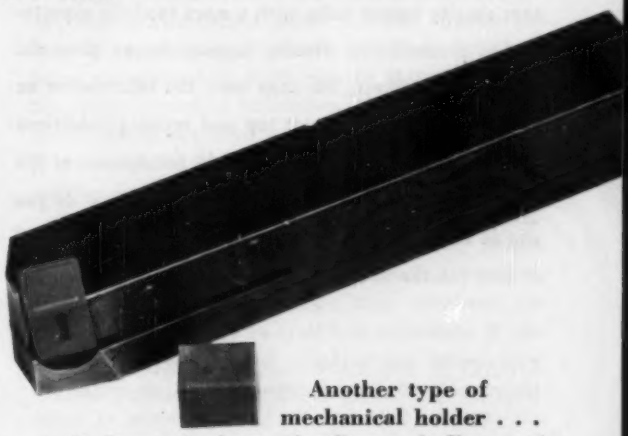
Tool setup and change-overs on short runs are frequent enough without the added loss of time caused by worn tools. The longer tool life gained with ceramics is a distinct advantage in these short-run operations.

A typical setup in which this gain is realized is one where throwaway triangular inserts produce about 45 pieces per tip before they become worn. By turning this tool over, the operator can make a total of 270 pieces before disposing of it. On this job a rough machining cut is made on 4130 material ¾ in. in dia and 6 in. long. Supported in the chuck of a lathe with a center in the opposite end, the part is turned at 390 sfm with a 0.010-ipr feed and a depth of cut of 0.062 in. The part is reversed after a 3-in.-long cut is made with a Diamonite insert in a Viking holder. Surface finish for rough turning runs about 80 mu-in. rms, and the part is ground afterward.

In addition to what is being learned about ceramic tools in actual production applications, a great deal of experimenting is being carried out in the firm's Production Development Laboratory. Here oxide tools of all kinds are run on various materials under different conditions. Results are recorded and recommended speeds, feeds, and other data are supplied to the shop. One of the big problems at North American Aviation is machining high-temperature, heat-resistant alloys. It is expected that further development work with oxide tools will facilitate this work.

Rigid clamping . . .

. . . of oxide tools in holders is essential to prevent chipping. Square throwaway inserts, such as this Alsimag Grade 162 P3, provide eight cutting edges if care is taken to prevent shattering the side under the edges in work



Another type of mechanical holder . . .

. . . is this Sintox unit, shown with a Sintox tool. Chatter and vibration that might damage toolbit are avoided by properly supporting work in the machine and by maintaining as much rigidity as possible between the tool and the holder

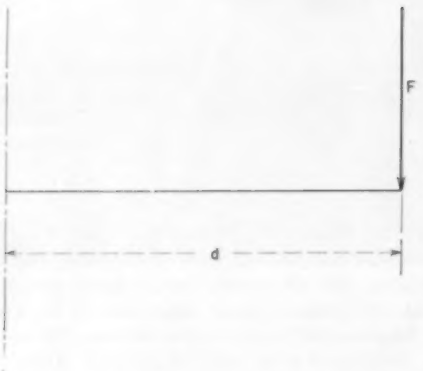


FIG. 1 . . Torque = Fd

FIG. 2 . . Torque dynamometer with Baldwin strain gage mounted between tap holder and spindle

What horsepower for tapping?

Horsepower = 0.0002 x Torque (in pound-feet) x RPM

Measurements of tapping torque provide the answers to many of the problems found in production tapping. First, knowledge of the torque aids the tap designer. Second, familiarity with torque factors helps the product engineer specify tapped holes with a more realistic expectation of producibility. Finally, tapping torque gives the production engineer, the shop man, the information he needs to select the correct tap and tapping conditions to produce the best result. The right horsepower at the machine is important to tapping efficiency. *How do you decide how much power is needed; which machine-tool is best for the job?*

STUART E SINCLAIR, director of research
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Satisfactory tap performance on almost any job is associated with the tap design that produces the lowest tapping torque. Many phases of tap design influence tapping torque and it is desirable to choose a design that will result in a combination of low tapping torque, maximum tap performance, and a tapped hole that meets specifications.

Some of the many variations in tap design are: different cutting-face angles, flute shapes, chamfer angles, thread relief, chamfer relief, point diameter, number of flutes, spiral or straight flutes, and gun or hand taps. However, when tap design for a particular job is being studied the number of variables decreases because the requirements of the job will indicate those designs which are impractical.

The combination of flute shape, number of flutes, and land width will influence the tapping torque, particularly in the small taps where chip space and breaking strength of the tap are critical. It is necessary to provide a compromise design in those cases to obtain the strongest tap possible that provides sufficient chip space plus a flute shape to give a cutting edge with as much hook angle as possible. Tapping torque measurements will guide the designer in obtaining the best compromise to fulfill the desired conditions.

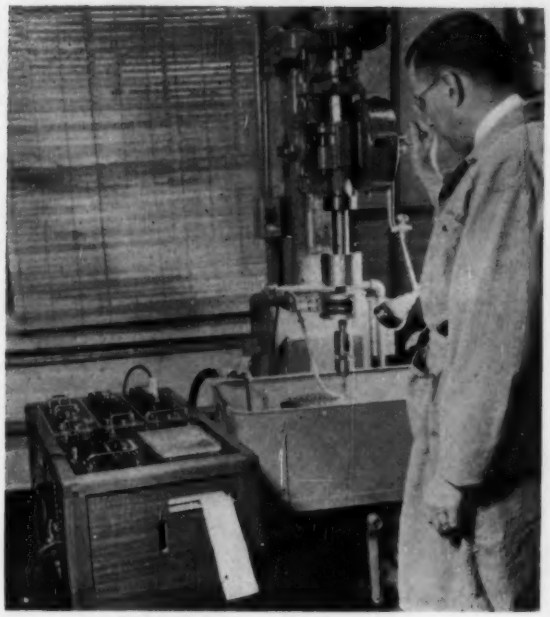

FIG. 3 .. Torque recording equipment

Gun taps provide a lower tapping torque than hand taps in material producing stringy chips (Fig. 4).

This lower torque results from a combination of the shear-cutting action of the gun tap plus the direction of chip flow during tapping, namely, the chips are pushed *ahead* of the tap during tapping, which eliminates any clogging of flutes, and the cutting action provided by the shear angle of the chamfered portion. There is also a better opportunity for the cutting fluid to reach the chamfer portion of the gun tap because there are no chips in the flutes to obstruct the flow.

The necessity for the chips to pass up the flutes of hand taps results in greater friction that causes tap breakage in small taps, and even in larger taps if the tapped hole is deep. However, if the hole to be tapped is bottoming or has only a little chip room at the bottom, a hand tap must be used. The cutting-face angle will influence the torque required for tapping material producing stringy chips, with greater angles requiring less torque (Fig. 5).

However, the greatest amount of hook, which would require the least tapping torque, cannot always be used because of factors such as overall tap strength, finish, hole size, thread strength, chamfer, and other considerations which must be included in deciding on the best tap design for a particular job.

TAPPED HOLE SPECIFICATIONS

The specifications for the tapped hole will include class of thread, bottoming or through hole, smoothness of thread, depth of hole, thread pitch, and percentage of thread required. The last three items

How torque is measured . . .

Inquiries received by the laboratory suggest that the basic meaning of torque is not always entirely clear. Some elementary definitions will assist those people who have not had recent occasion to use such terms. *Torque* is the energy produced when a force "F" acts to produce rotation about a center at a distance "d" from the line in which the force acts. It can be expressed by the formula: Torque = F d. Torque may be expressed in several ways such as pound-feet, pound-inches, ounce-inches, or in other ways when the metric system is used but, as indicated above, expression of the final value depends upon the units used for the force applied and the distance from the axis.

Units specifying torque usually depend upon the amount of torque applied, a very small torque value being expressed in ounce-inches while a large torque is measured in pound-feet. The intermediate pound-inches unit is usually used for tapping torque because most studies are associated with the smaller taps having tapping torques under 150 pound-inches.

The horsepower required can be determined if the tapping torque and tapping speed are known. Torque involves energy applied at any instantaneous time, but horsepower takes into consideration the energy applied for a definite length of time. One horsepower equals 33,000 pound-feet of energy applied for one minute. A simplified formula to determine the horsepower when the torque and tapping speed are known is: Horsepower = 0.0002 X Torque (in pound-feet) x rpm.

Several methods are used to determine tapping torque, but the method used in our laboratory utilizes torque sensitive units, having various torque ranges, which are installed between the driving spindle and the tap holder.

Torque measurement is produced through the use of bonded-wire strain gages installed within the unit. Each strain gage consists of a short length of wire, approximately 0.001 inch in diameter, which has high electrical resistance. To keep the gage length short, the wire is formed into a grid which is cemented between two thin pieces of paper, each smaller in size than a postage stamp.

Grids of this type are cemented to torque-sensitive beams inside the torque pick-up unit. Torque applied to the unit causes elongation of the wire strain gages, which increases their electrical resistance. This change in electrical resistance is amplified and recorded in terms of the torque produced in the tapping operation. Recording equipment is sensitive to a degree that permits the measurement of tapping torque required for even the smallest machine-screw taps, which may be less than five pound-inches.

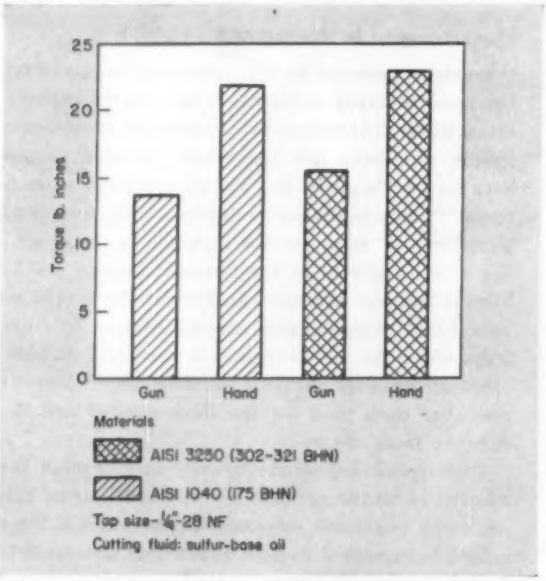

FIG. 4 . . Tapping torque—gun vs hand taps

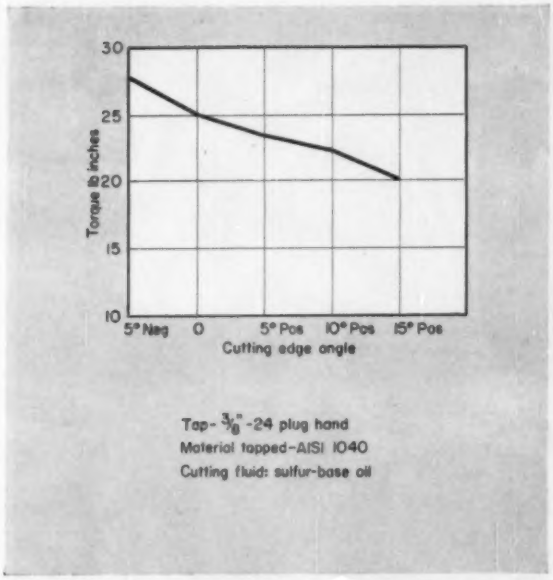

FIG. 5 . . Cutting edge angle vs tapping torque

can be studied by torque measurements and the last item, percentage of thread, is of major importance in its effect on tapping costs. Tapping torque required for varying percentages of threads in two materials, as shown in the graph (Fig. 6) illustrates clearly how tapping torque is reduced progressively as the percentage of thread is decreased. This reduction is entirely logical as less material is removed hence less energy is required to remove the material to produce the tapped thread form. The curves in Fig. 6 were obtained with a plug gun tap so there would be no chips in the flute to influence the values. However, specification of a minimum percentage of thread is more important when a hand tap is used because the chips are accumulated in the flutes. The smaller the volume of chips produced, the less tendency to cause clogging and excessive tapping torque, which causes tap breakage. It is always desirable to specify the lowest percentage of thread possible to achieve the lowest cost per tapped hole.

Extensive research has been done on the strengths provided by various percentages of thread, which reveals that, as a whole, 60-65% thread results in strengths more than adequate for most applications. The importance of percentage of thread cannot be over emphasized to the design engineer because specifying a threaded hole with a higher percentage of thread than is necessary can drastically increase tapping cost. When very hard metals, or other materials difficult to tap, are used, the percentage of thread specified may determine whether a standard or special tap is required. This decision directly affects manufacturing costs. It is most important that design engineers responsible for specifying the percentage of thread in tapped holes be fully informed on the physical properties associated with various percentages of thread.

Measurements of tapping torque reveal the effect of chips when tapping bottoming holes. Holes one and one-half diameters deep will cause trouble with chip accumulation, particularly with the smaller taps. If deeper holes are specified the tapping costs will be greatly increased by tap breakage resulting from the excessive tapping torques required to overcome the effect of chip clogging. Torque measurements emphasize the contrast between bottoming and through holes because the stronger gun tap which pushes the chips ahead may be used on the through hole thereby eliminating all chip accumulation difficulties.

The choice of thread pitch is particulary important if the material being tapped has very high tensile strength. Figure 7 shows the torque required for tapping several sizes of NC and NF threads in medium-high-strength material. However, the whole story is not revealed by the torque measurements because of the difference in thread pitches affecting the strength of the tap. It is obvious that the coarser pitch will require the cutting of a large volume of material so more chips are produced. Also, the coarser thread tap requires lands cut to a greater depth which reduces the strength of the tap because of the larger amount of metal removed from the outside diameter of the tap where stress is at a maximum when torque is applied. In the case of hand taps, the flute area available for chips is reduced because of the deeper NC thread and there are more chips produced to fill the flute area hence there are two conditions which adversely influence tapping conditions. Therefore, the greater differences in tapping torque shown in Fig 7 plus the effect of the conditions discussed above emphasize why the finer NF series is preferable, particularly if the material being tapped is in the high-hardness range

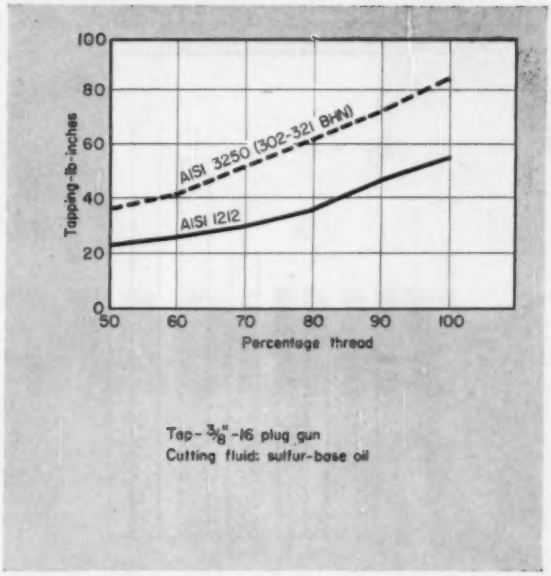

FIG. 6.. Torque vs percent depth of thread

or is a composition that is inherently difficult regardless of the hardness. It is therefore apparent that for hand taps the NC series is more likely to break.

CUTTING FLUID

The influence of cutting fluids on tapping is revealed most clearly by torque measurements (Fig. 8). The graphs require little discussion as it is revealed so clearly that tapping costs and the quality of results can be greatly influenced through the choice of the proper cutting fluid correctly applied. There are many jobs in which the tapping operation is not difficult, such as through holes in easily machined material, where the choice and quality of cutting fluid may not be of major importance. However, as the material being tapped becomes more difficult it is of utmost importance that the proper cutting fluid be used and it must be applied in the proper manner: that is, in sufficient volume at the right location to obtain the greatest effect.

A tap is difficult to lubricate under the best of conditions because the cutting fluid must flow down the flutes for taps of standard designs. If a hand tap is being used in a bottoming hole, the chips clog the flutes which prevents a free flow of fluid so the cutting fluid that first enters the hole to be tapped is providing the major cooling and lubricating effect. It is evident that the use of a hand tap in a through hole would produce a more difficult condition for proper lubrication and cooling at the cutting portion of the tap. The cutting fluid first entering the hole would run out and the combination of the chips in the flutes plus the rotation of the tap would allow only a minimum of the cutting fluid that followed to reach the chamfer or cutting portion of the tap. Such a condition further emphasizes the use of gun taps on through holes because there would be no chips in the flutes to hinder the flow of cutting fluid to the cutting areas of the tap.

TORQUE VS HORSEPOWER

All of the foregoing leads us to the most efficient use of the tap, up to the point of machine selection. But, how much power is needed to actually cut the thread? Excessive power is wasted machine time and money. Too little power means lost production, possible work hardening of the material being threaded, poor thread finish, reduced tool life, and a number of other costly inefficiencies.

It pays to use tapping equipment that provides the proper power. This factor is especially worth watching, because the danger is greater, when multiple-spindle tapping or combination drilling and tapping are used. However, because of the many variables in taps, tap designs, use of cutting fluids, materials tapped, regrinding techniques, etc, it is impractical to set up a definite torque table or horsepower requirement, for all tap sizes and materials to be tapped, and expect it to be applicable for all users. Fortunately, the power requirement is not critical as long as it approximates, preferably on the high side, the correct amount.

Companies using large numbers of taps, special thread sizes, or working materials are wise to set up their own torque testing equipment. It makes possible not only better production and longer tool life but considerably improved product quality. Smaller firms and job shops can use published torque values, plus prescribed tapping practice, and determine by formula a fairly accurate horsepower requirement.

The box—"How torque is measured"—gives the formula for determining horsepower when the torque is known. Power varies, for a given diameter, almost in proportion to the square of the pitches. Similarly, the power varies directly as the surface speed (in feet per minute) and as the diameter. When the power required to cut one thread size has been determined, it is possible to find the approximate power required for any other size at any given speed. The formula is:

$$HP_x = HP_a \times \frac{S_x}{S_a} \frac{(N_a)^2}{(N_x)^2} \times \frac{PD_x}{PD_a}$$

Where: HP_a is the known horsepower determined from the original thread size a.
HP_x is the unknown horsepower for the tap to be used.
S_x is the tapping speed (in sfpm) of the tap to be used.
S_a is the tapping speed (in sfpm) for the known thread.
N_a is number of threads per inch of the known tap.
N_x is number of threads per inch of tap to be used.
PD_x is pitch diameter of tap to be used.
PD_a is pitch diameter of known tap.

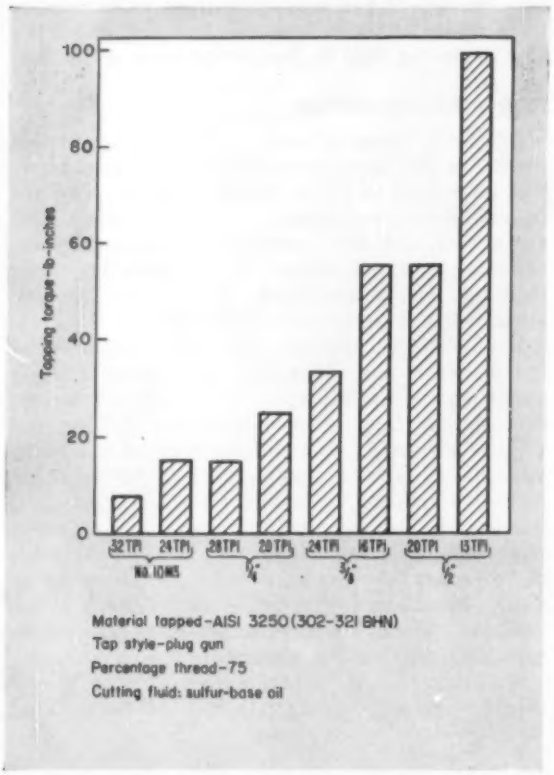

FIG. 7 . . Torque vs thread pitch

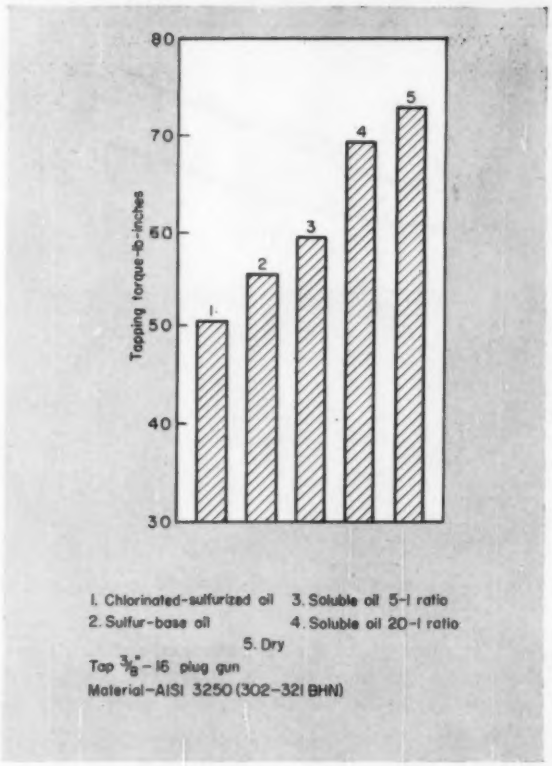

FIG. 8 . . Torque vs cutting fluid

HOW MATERIALS AFFECT HP REQUIREMENTS

Because materials other than those ordered with very carefully specified machining qualities vary so widely in these qualities, depending on composition, heat treatment, and source of supply, it again becomes difficult to give a set of positive figures. In our extensive torque testing program we have found wide variation in torque readings on what appeared to be the same material. Only carefully controlled batches gave us the repeat results we were seeking. Hardness tests do not always provide a complete answer.

However, as a general rule, and using the correct tap conformation, the ratio of horsepower requirement between screwmachine stock and chrome-nickel alloy seldom exceeds 5 to 1. On the other hand, 2S-0 aluminum needs less than half of the power used with screwmachine stock.

One of the best guides to determining horsepower for tapping is the standard machinability table, provided it isn't used as law, for the reasons previously mentioned. Torque testing is always the safest power indicator. Machinability tables can be found in the *"New American Machinist's Handbook"* and in the discussion of the US Air Force Machinability Report (*AM*—Oct 1 '51, p161). Materials having similar microstructure generally have similar machinability. Thus, while it has been common to measure machinability by the Brinell hardness, the latter may not be an accurate guide because two unlike steels may have the same hardness and very different microstructure.

MULTIPLE THREADS

Inasmuch as the power requirement varies directly as the diameter, the speed, and the square of the pitch, what happens when multiple threads are cut? Tests show that if the power required to cut a single thread is established as 100% then the power required to cut a double thread is slightly more than 200%. About four and one-half times as much power is needed to cut a quadruple thread as for the single thread.

Finally, remember that applying more power, or torque, than the tap is designed to take may result in more broken taps than increased production hence it is important to follow recommended cutting speeds, with the appropriate power, unless you are sure of the actual torque values. Also, don't neglect consideration of the power loss between the motor and the cutting edge. A bent or binding spindle can double the power requirement. A dull tap can call for twice as much power as a sharp tool. Slipping belts can drain off power the motor rating indicates is reaching your tap. With all of these factors weighed into the setup, tapping will be a more efficient, and more pleasant, operation.

HOW TO MACHINE GRAY AND NODULAR IRON

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American Machinist
SPECIAL REPORT No 444

The excellent machinability of iron castings is one of their important properties. Because of this fact, cast iron is too often machined without studying the operation to get the required quantity and quality at the minimum cost.

Because it is not unusual for the cost of machining to be many times the cost of the material, good practice should be emphasized even when there appears to be no problem in machining.

This practical guide to the machining of cast iron has been prepared for inclusion in the forthcoming "Gray Iron Handbook" to be published by the Gray Iron Founders' Society.

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HOW TO MACHINE GRAY AND NODULAR IRON . . .

GRINDING THE CUTTING TOOLS

The productivity and cost of the machining operation depends to a great extent upon the care that has gone into the sharpening of the cutting tools. To achieve efficient machining, the tool must be sharpened correctly. All the damage and wear due to previous use must be removed, correct tool geometry and a fine finish should be obtained. Only then can efficient operation be expected.

The selection of the proper grinding wheel for each tool-sharpening operation is most important, and the wheel manufacturer's recommendations should be followed (also see *AM*—Aug 28 '47, p101).

The machine—Cutter grinding machines, whether simply stand grinders for off-hand grinding, or complex machines, should be kept in good condition. It is important that spindles be free from vibration and end play, and that the machines be kept clean. This provides the opportunity as well as some incentive to do accurate grinding.

In wet grinding, the flow of coolant should be steady. If the coolant flow is intermittent, alternate heating and quenching can occur, and may result in heat checking or cracking of the carbide.

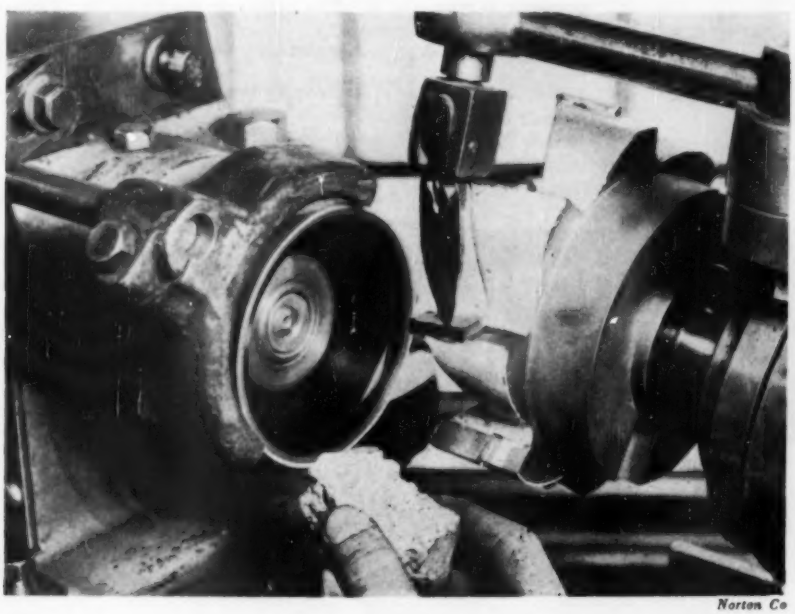
In dry grinding care must be taken not to overheat a tool. On high-speed-steel tools, overheating will temper the tool and cause it to lose hardness. If the cutting edge has been discolored in grinding, tempering due to overheating has taken place. This cannot be corrected by just removing the discoloration or polishing the cutting-tool surfaces. When the tool surface has been tempered, the soft section will extend into the tool for some distance, depending upon the severity of the overheating, and all the softened metal must be ground away in order to regain a cutting edge of original hardness.

Grinding wheels must be kept sharp and clean with suitable dressing devices. Diamond wheels are best dressed with pumice. If a diamond wheel becomes badly worn, it can be reconditioned by rotating it very slowly and grinding it with a soft, porous aluminum-oxide wheel.

In regular tool grinding, aluminum oxide, silicon carbide, and diamond wheels should be run at 5000 to 6000 sfpm.

Grinding single-point tools—In grinding single-point tools, the wheel should always revolve down into the cutting edge. The tool should be kept in motion to prevent localized heating and to prevent localized wear on the face of the grinding wheel. The top face of the tool should be ground first; then the side and front reliefs, and, finally, the nose radius. Chipbreakers are not required in machining gray cast iron.

In grinding carbide tools, the steel shank should



Pumice . . . is used to dress a diamond wheel

Norton Co

first be ground away on a suitable aluminum-oxide wheel. If a tool is badly worn or broken and a "green grit" silicon-carbide wheel is used to hog off material, both carbide and steel shank can be ground on the same wheel. But a steel shank should never be ground on a diamond wheel, because it tends to load the wheel and reduce its life.

Milling cutters—In most milling-cutter grinding operations, the wheel is rotated up and away from the cutting edge of the tool for safety.

In grinding high-speed steel or cast alloys, in-feeds should not exceed 0.002 in. for roughing, and 0.001 to 0.002 in. for finishing. In grinding carbides, roughing in-feeds should not exceed 0.0005 in., and finishing feeds 0.0003 in.

Broaches—In grinding broaches, special care must be taken to produce a fine finish on the teeth and not to overheat them. In-feeds should not exceed 0.001 to 0.0015 in. on high-speed steel and 0.0003 to 0.0005 in. on carbide.

Broaches usually are sharpened by grinding the face of the teeth. When the teeth get too thin after about one-third of the tooth width has been ground away, the broach is reprocessed by grinding the top of teeth. Care should be exercised in obtaining the correct rake or hook angle and in reproducing the original chip space or foot radius. If this radius is ground incorrectly, poor work finish and eventual tooth breakage may result.

Usually a fine burr is left on the broach teeth after sharpening. In some instances, the broach can be placed on the machine in this condition and the burr will be removed by the workpiece during the first trial cut in set-up. To improve finish and tool life, this burr should be removed by a copper lapping stick, a fine steel brush, or by vapor honing.

Drills—Less attention usually is paid to the sharpening of drills than to the reconditioning of any other tool, although poor finish, runout, oversize, and out-of-roundness can be attributed directly to poorly maintained drills. For efficient and accurate drilling, the two cutting lips must be of equal length. The point and clearance angles must be correctly maintained. It is definitely recommended that drills be machine sharpened.

Reamers—Machine reamers are sharpened by removing the wear on the chamfer. Where a reamer has a starting taper, the tapered section is reground. Care should be taken to produce a fine finish on the teeth. It is recommended that reamers be frequently checked for straightness and runout, for they can be sprung sufficiently to be inaccurate without being obviously bent.

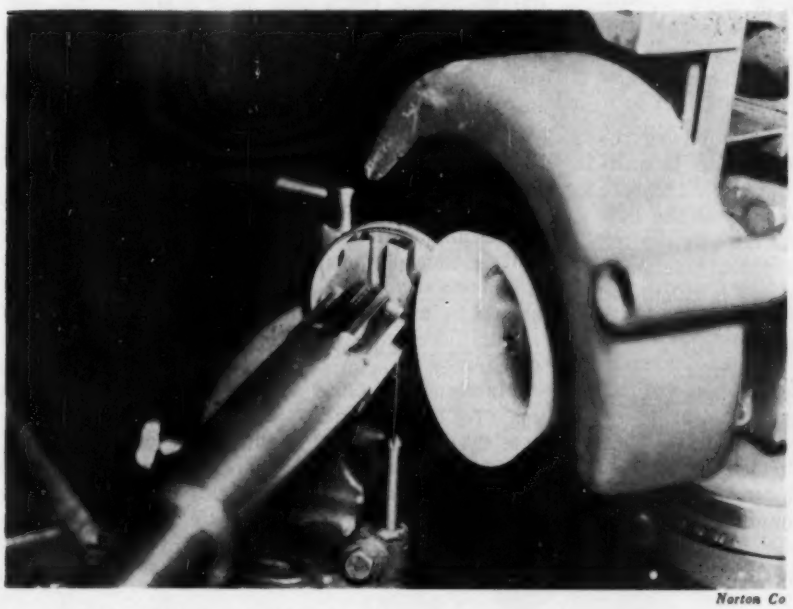
MACHINE TOOL REQUIREMENTS

Rigidity in a machine tool is of utmost importance for good tool life, surface finish, and dimensional control. The presence of vibration or chatter will usually result in decreased tool life, poor surface finish, difficulties in holding dimensions, and broken cutters.

Rigidity in a machining operation depends on a number of factors:

1. The basic design of the machine
2. The condition of the machine (looseness in bearings, spindles, gibs, etc) due to wear or misadjustment
3. The amount of tool overhang
4. Fixture design and workpiece setup
5. Work geometry (thin sections, etc)

If a machine is overloaded structurally, chatter usually results. The selection of feed is often based on the maximum the machine can take without the development of serious chatter. When the original set-up is made, the cutting tool is sharp. As the tool begins to dull, the forces on the tool, the workpiece,



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Grinding the chamfer . . . of a reamer to remove the wear

and the machine increase rapidly. If a feed or depth of cut is selected to load the machine to its full capacity when the tool is sharp, dulling of the tool will overload the machine and can result in chatter or even tool breakage.

Looseness in any of the moving parts of the machine tool is a source of chatter in machining. This is especially the case with interrupted cuts as in milling. The higher cutting speeds also make balance important. With high centrifugal forces on the rotating parts, lack of balance tends to induce chatter in a machine tool.

In drilling and reaming, the shortest possible tool for the job should be used. If a long tool is unavoidable, it should be given proper support to obtain the required finish and accuracy. Broaches must be well supported along their entire length and the work must be rigidly clamped and well backed up, because unusually heavy pressures are typical in this operation. It is also good practice to check out sub-bars periodically to determine that they are square and parallel.

Power requirements—The power required in machining depends on several factors, some being interrelated:

1. Type of machining operation
2. Hardness and microstructure of work
3. Cutting speed
4. Feed, depth, and width of cut
5. Tool angles
6. Sharpness of cutter

A convenient term for defining the power required to remove metal at a given rate is unit-horsepower, hp_c, the horsepower per cubic inch per minute. The total horsepower required at the cutting tool then is the product of unit horsepower and rate of metal removal. For several typical machining operations, the rate of metal removal is calculated as follows:

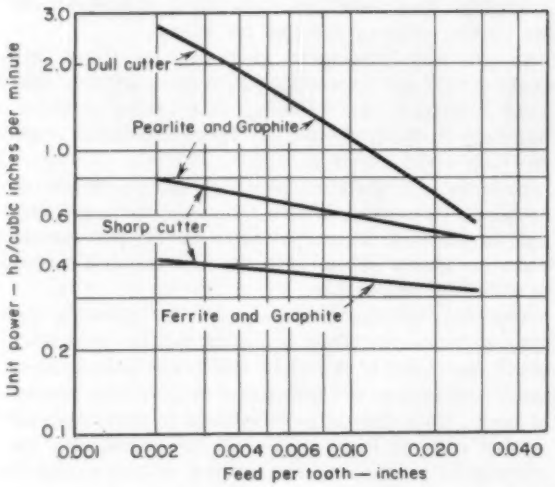
Turning = feed/rev x depth of cut x 12 x cutting speed in ft/min.

Milling = feed/tooth x No. of teeth x depth of cut x width of cut

Drilling = $\frac{\pi D^2}{4}$ x feed/rev x rev/min (D = dia of drill)

Planing = feed/stroke x depth of cut x 12 x cutting speed in ft/min.

The horsepower of the motor is then obtained by dividing the cutter horsepower by the efficiency of the machine tool, which is usually about 80%.



USAF Machinability Report

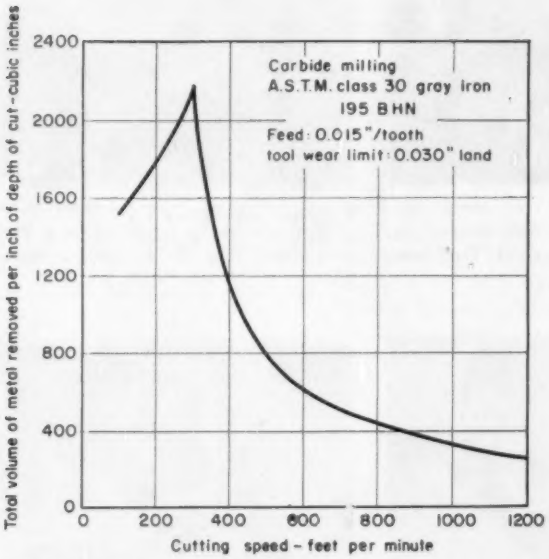
Power requirements . . . increase as the cutter drills

Except in the fully annealed condition, all cast irons require about the same power in machining. The differences are negligible when one realizes that the power consumption may increase as much as 300% as a result of the cutter becoming dull. General values for the power requirements of various machining operations, with sharp cutters, are listed. Note that the horsepower readings are given for feeds of about 0.010 in. This is important because the power used is a function of the feed. The hp/cu in./minute required for cutting decreases as the feed is increased. With a sharp cutter machining a pearlitic iron at a feed of 0.002 ipt, the power requirement was 0.8 hp/cu in./min, while at a feed of 0.020 ipt the power consumption was only 0.50 hp/cu in./min.

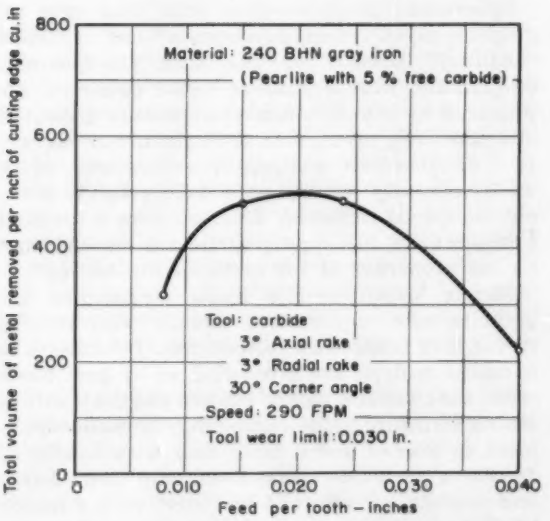
It is thus obvious that to determine the power requirement for a machine-tool motor, allowances should be included for dulling of the cutter as well as for the efficiency of the transmission within the machine.

Maintenance—Good machine maintenance is a must for efficient operation. It is impossible to maintain the production of quality work with equipment that is in need of repair. Spindles must be kept free from end play; bearings and gibs must be properly adjusted. It is also well to level all pieces of equipment periodically. The starting point for good maintenance is a cleanly kept machine.

MACHINING PROPERTIES OF IRON CASTINGS



Typical peak in a tool-life curve . . . for cast iron occurs at about 300 sfpm. Above the peak point an increase in speed results in a decrease in tool life. The drop in tool life at speeds below 300 sfpm is characteristic of cast irons



Tool life curves courtesy USAF Machinability Report

Effect of feed . . . on tool life in milling. Up to a point better life is obtained at higher feeds. Feeds should usually be selected before speeds, and depend on rigidity, power available, and surface finish

There are three conditions by which a material can be readily evaluated in the machining operation. They are:

1. The life of a tool in cutting the material
2. The quality of surface finish obtained
3. The tendency for the work to distort when machined

Tool Life—Economically, tool life is generally the most important of the machinability factors and it is commonly used to evaluate the ease with which a material may be machined. The wear on the flank of the tool is an effective yardstick for evaluating tool life. When the wear reaches a predetermined amount (0.030 in. for carbide tools) the volume of metal removed is calculated and the machining time is noted. This data makes it possible for curves to be drawn for:

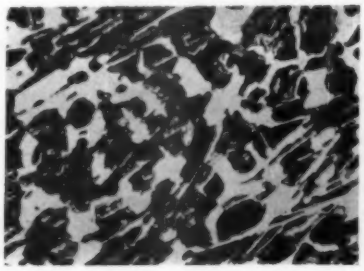
1. Volume of metal removed vs cutting speed
2. Tool life in minutes vs cutting speed.

The most practical cutting speed and production rates may be determined from these curves. The tool-life curves, which are shown, relate volume of metal removed to cutting speed. In order for the term "volume of metal removed" to have significance, the depth of cut must be specified. In these curves, the values for tool life are expressed in cubic inches of metal removed for a one inch depth of cut. With this unit depth, the data on a curve may be conveniently converted to any desired depth of cut by changing the value for metal removed in direct proportion to the depth of cut being considered. For example, if the depth of cut is 0.250 in., the volume of metal will be one-fourth that cited in the tool-life curves. The tool life, in terms of time, is independent of depth of cut.

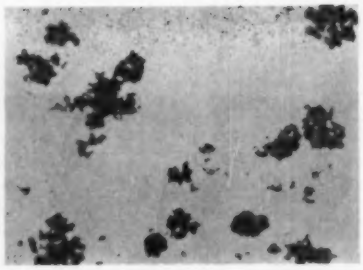
Microstructure of cast irons—Metal-cutting research has demonstrated that the microstructure is a more direct criterion of a work material's influence on tool life than is its chemical composition or hardness. The chemical composition and rate of cooling determine the microstructure of the metal and its resultant hardness so that all of these factors are interrelated. Unfortunately, the correlation between these factors is not direct. Certain micro-constituents influence the hardness more and others less than their corresponding effect on machinability. Although hardness is generally a good indication of machinability, the microconstituents within the metal directly determine its machining properties.

The microstructure of cast iron consists of two principal parts: the graphite, which may occur in several different forms, and the surrounding metal, which is commonly called the "matrix structure." White cast iron (sometimes called "chilled iron") and certain high-alloy irons are exceptions to this, since they may not contain any appreciable amount

HOW TO MACHINE GRAY AND NODULAR IRON . . .

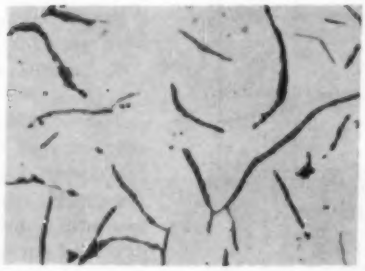


White iron . . .
at 250X with an acid etch. White areas are iron carbide (cementite). Dark areas are pearlite

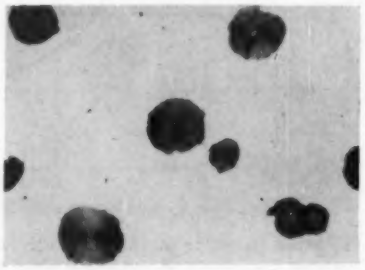


Temper carbon . . .
of malleable iron at 250X, unetched. This form results from the annealing of white iron

Photomicrographs courtesy American Brake Shoe Co



Flake graphite . . .
of gray iron at 250X, unetched. This is one of several arrangements that can be made to occur



Spherulitic . . .
graphite of nodular iron at 250X, unetched. The radial structure is typical of graphite in this form

of graphite. In these graphite-free irons, the carbon is all chemically combined with the iron as iron carbide. This appears under the microscope as areas of a white, very hard constituent (cementite).

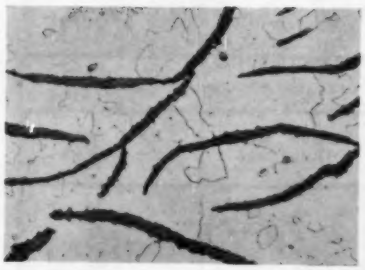
Graphitic structure—The graphite in cast iron provides many of the metal's unique characteristics, and the form that it takes has a prominent influence on the mechanical properties of a casting. Differences in graphite structure have only a minor influence on tool life, but are important where surface finish is critical.

There are three basic shapes in which graphite can occur in cast irons: *flake graphite, nodular graphite,* and *temper carbon.* The latter is formed in the annealing of white iron and occurs in malleable cast iron. The other two form during the solidification of the iron in the mold and are of concern here.

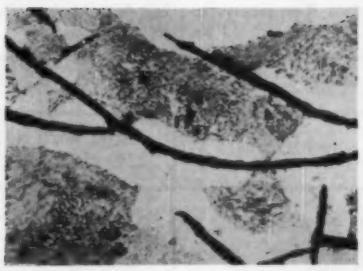
Flake graphite—This form occurs in gray iron. It is essentially plate-shaped, but may vary widely in sizes, thickness, and arrangement. There is an ASTM standard for the classification of flake graphite size and type (No. A247-47). In the flake form, the graphite has the greatest influence on the properties of the casting.

Spherulitic graphite—Iron with this type of graphite is of recent development and is called "nodular," "Ductile," or "SG" iron. The spheroids of graphite, with a peculiar radial structure, are produced by the introduction of minute quantities of a nodulizing agent, such as magnesium or cerium, to a suitable base analysis of molten iron which would normally solidify with flake graphite without the special treatment. Since a sphere is the most compact form, this type graphite has less influence on the properties of the metal in the casting.

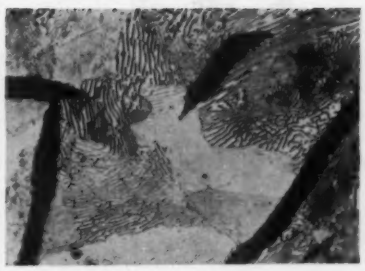
Matrix structure—The metal surrounding the graphite may be compared directly with steel in its range of possible microstructures. By changes in chemical analysis and processing, or by heat treatment, the combined carbon content and the resulting matrix structure in the casting may be made equivalent to that of a soft mild steel with nearly all ferrite, a medium-carbon steel with both ferrite and pearlite, an eutectoid tool steel with a matrix of all fine pearlite, or a high-carbon tool steel containing pearlite with a carbide network. To this range of structures should be added all those obtainable by heat treatment, the very machinable spheroidized carbides, the austempered structures,



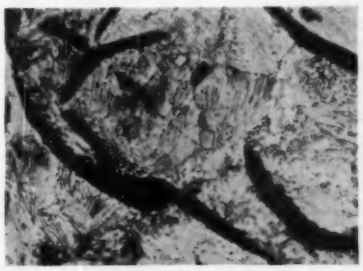
Gray iron . . .
with a ferrite matrix at 250X, unetched. Ferrite is essentially carbon-free iron. Carbon from the matrix is deposited along the graphite flakes



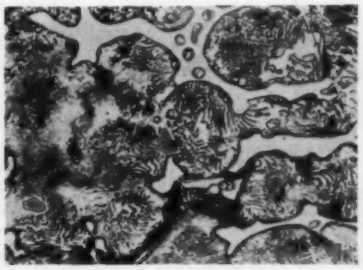
Gray iron . . .
with a mixed matrix of ferrite and pearlite at 250X, etched



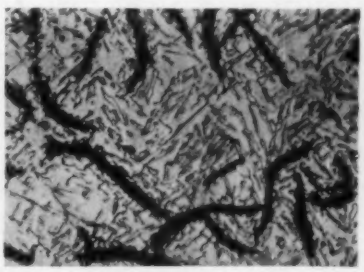
Fingerprint structure . . .
of coarse pearlite at 500X, etched. It is caused by alternate layers of iron carbide and ferrite.



Mother-of-pearl appearance . . .
of fine pearlite at 500X, etched. It is from this form that pearlite derives its name



Pearlite and free carbides . . .
at 250X, etched. Free carbides may be formed by fast solidification or by the addition of alloys such as chromium or vanadium



An acicular matrix . . .
in gray iron at 500X, etched. This structure is obtained directly in the casting (without heat treatment) by alloying, usually with nickel or molybdenum

the very hard martensite, and the tempered martensites. The possible changes in the matrix structure of cast iron may be more readily understood, if it is remembered that the matrix of cast iron can be self-carburized or internally decarburized by heat treatment to any combined carbon content within the entire range in which steels are made.

The matrix structure (that part of the microstructure that surrounds the graphite) is most directly related to tool life. Since there is a wide variety of matrix structures available in cast iron, tool life can be varied over a very wide range. Ferrite, the microconstituent that is relatively carbon free, is by far the most machinable from a tool-wear standpoint.

The most difficult structure to machine is one containing massive areas of the extremely hard iron carbide. This is typical in the structure of white cast iron, which, because of the extremely poor tool life, may ordinarily be considered unmachinable, but is machined commercially in special circumstances. Pearlite is actually alternate layers of soft ferrite and hard iron carbide and is a common constituent in gray cast iron. The finer this structure is, the stronger and harder it is and logically the more difficult to machine. Irons containing mixtures of ferrite and pearlite have intermediate machinability.

Iron may be produced containing iron carbides which are not contained in pearlite. These free carbides may appear as small masses, or as a network around the pearlite. Free carbides decrease the machinability much more than the amount of carbides present would indicate.

Several factors influence the matrix structure of a casting. The most important of these are the chemical analysis of metal, its cooling rate in the casting, and subsequent heat treatment (when it is used).

Machinability data—The presence of the graphite is important to tool life through its effect as a chip-breaker and lubricant, but the shape and the amount of graphite are not critical to tool life within the ranges that occur in the common types of cast irons. Tool life is directly affected by the microstructure of the matrix which contains the graphite.

The presence of free carbides in the structure of cast iron is detrimental to tool life. As little as 5% free carbide can reduce tool life as much as 70%. Compare the tool-life curves for two pearlite gray

HOW TO MACHINE GRAY AND NODULAR IRON . . .

Power Requirements for Machining Cast Iron with a Sharp Cutter

OPERATION	HP/cu in./min at Cutter		
	SOFT IRON 160-193 BHN	MEDIUM IRON 193-220 BHN	HARD IRON 220-240 BHN
Turning	0.6	0.7	0.75
Planing	0.45	0.5	0.55
Drilling	0.55	0.6	0.65
Milling	0.6	0.65	0.70

Typical Hardness Range for Four Matrix Structures

Matrix	Low & Medium Strength Gray Irons	High-Strength Gray Irons	Nodular Irons
	Bhn	Bhn	Bhn
1. Ferrite (fully annealed)	110-140	120-160 [1]	140-200 [4]
2. Coarse pearlite, or pearlite and ferrite	140-190	—	200-270 [5]
3. Fine pearlite	190-230	200-240 [2]	240-300 [6]
4. Acicular (alloy or heat-treated)	220-320	220-320 [3]	270-350 [7]

Notes:
1. Strength is appreciably lowered by annealing.
2. Typical of ASTM Class 40 and 50 iron.
3. Typical of ASTM Class 55 and 60 iron.
4. Typical of Type 60-45-10.
5. Typical of Type 80-60-03.
6. Typical of Type 100-70-03.
7. Typical of Type 120-90-02.

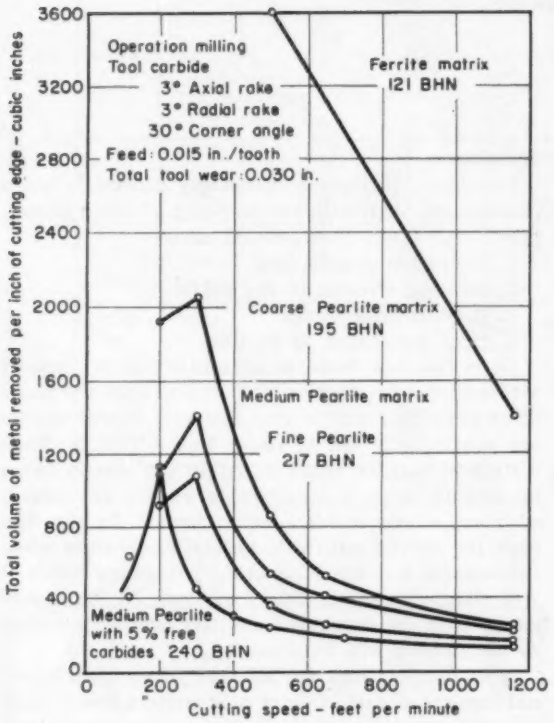
irons, which are similar except that one contains about 5% free carbide in the matrix structure. Thus, at 300 sfpm, the tool life for the iron without free carbides was 1300 cu in., and only 450 cu in. for the one with 5% free carbides in its microstructure.

Irons with nodular graphite can have a similar series of matrix structures and there is an equivalent relation to tool life. Although the Brinell hardness values of irons with nodular graphite are generally higher than with flake graphite, the machinability is essentially the same for the same type of matrix. The higher Brinell hardness with nodular graphite is the result of a generally higher silicon content and the more compact form of graphite. This typifies the inconsistencies which occur in relating machinability to hardness.

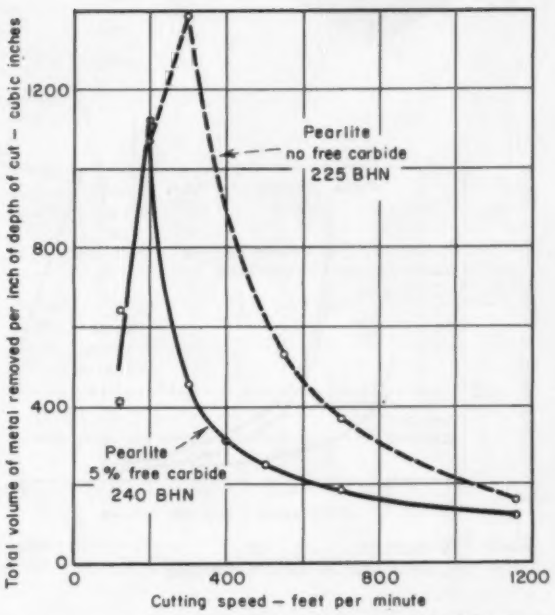
The wide spread that is possible in tool-life curves emphasizes the importance of selecting the proper type of iron. If machining costs are to be minimized, it is necessary to obtain the best machinability that is compatible with the other property requirements. The microstructure of the castings to be machined must be known if the optimum conditions are to be set up.

Casting skin—The first cut from the surface of a piece of metal can result in shortened tool life if the surface is not free from abrasive material. Castings are subject to this difficulty, since sand from the mold may adhere to the surface or actually be fused into the surface metal. At one time, when metal cleaning equipment was limited to the tumbling barrel, the emery stone, and the wire brush, the occurrence of a poor machining surface (by today's standards) was common and tolerated or corrected by rusting it off (weathering). With modern foundry practice and equipment, iron castings can be consistently produced with clean surfaces. There may be special cases where it would be more economical to tolerate a reduced tool life or lower cutting speed on the first cut than to utilize special casting or cleaning techniques to avoid it, but with the exclusion of an unusual casting design or requirement, quality castings should not present this difficulty, particularly when a normal depth of first cut is used.

In many modern production methods absolutely clean casting surfaces are essential. The machining of pipe fittings is an example. It is standard practice to have the tap run directly onto the cast surface at high speed without a preliminary cut and without excessive tool wear. Automation or continuous automatic machining of iron castings is be-



Tool-life curves . . .
in milling for a series of gray irons. Coarse pearlite has a tool life twice that of fine pearlite. Brinell hardness (195 and 217) would not indicate so large a difference.



Tool life curves courtesy USAF Machinability Report

Free carbides . . .
make quite a difference between two irons similar in all other respects

coming common practice. Its success depends upon consistently clean and accurate castings. Production tool life is equally as dependent upon clean and accurate castings as it is upon the properties.

SURFACE FINISH

Quality of surface finish is dependent upon the cutting speed, feed and depth of cut, the tool geometry, the set-up and condition of the machine, and the type of cast iron being cut. The graphite present in the iron has some influence on surface finish and considerable influence on the appearance of the surface. The presence of the graphite in the surface tends to make it appear gray and thus less smooth than it actually is. With some types of machining and certain irons, a portion of the graphite may be pulled out of the surface, leaving microscopic pits. Although this condition will affect surface appearance and the reading of an averaging-type surface analyzer, it does not change the fit or tolerances, and with movement between mating surfaces it can assist in retaining lubrication.

The surface finish obtained is influenced by the matrix microstructure as well as the size and shape of the graphite. The graphite in annealed irons (with a matrix of ferrite) is more likely to be pulled out of the surface. Finer flakes or nodular graphite in a matrix of fine pearlite will yield a better finish.

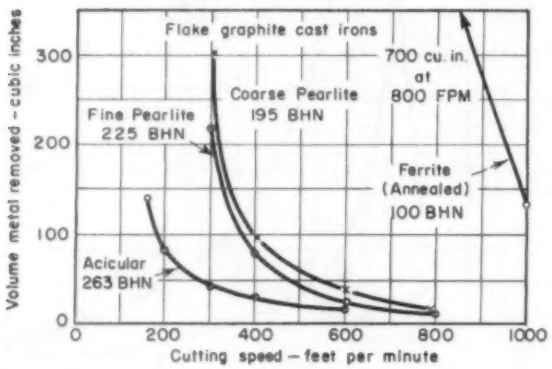
In a test of finish obtained in milling, the casting with finer graphite indicated a smoother surface, but this was mainly due to fewer pits rather than an important decrease in the trough-to-crest distance.

Surface finish is improved as the cutting speed is increased, but dulling of the tool may be either good or bad. If dulling results in a land on the end of the cutting tool which generates the work surface, finish may actually improve. Likewise, the nose radius on the tool which generates the surface has an important effect on finish. As nose radius increases, there is a tendency for the surface finish to improve.

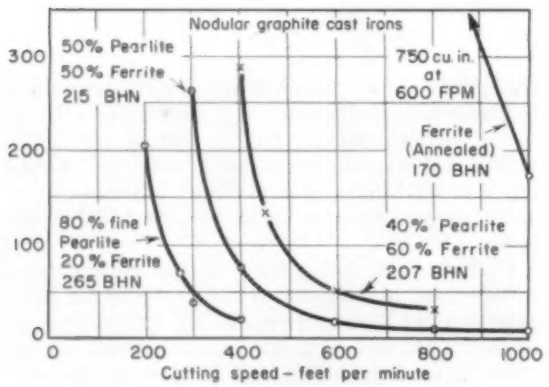
In milling, there is a tendency for breakout to occur at the edge where the tool leaves the work. Work breakout decreases as feed and depth of cut decrease and also as the structure or graphite size decreases.

Surface finish can be improved by using a light feed and shallow depth of cut. The quality of finish is far more sensitive to feed than to depth. At a feed of 0.005 ipr and a depth of 0.010 in., a surface finish of less than 50 mu-in. was obtained.

HOW TO MACHINE GRAY AND NODULAR IRON . . .



Tool life curves . . .
for turning are similar to those for milling



Nodular irons . . .
show tool life similar to flake graphite irons despite their higher hardness

Tool life curves courtesy USAF Machinability Report

DISTORTION

Distortion during the machining process is not a common problem with the majority of iron castings, but it may result from several causes:

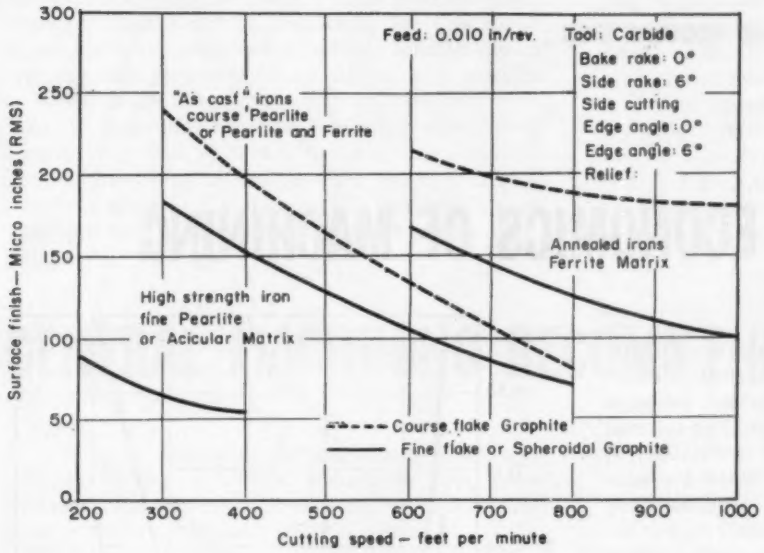
1. Distortion in clamping
2. Internal stresses in the casting
3. High cutting forces
4. Heat generated in cutting.

Open castings (such as gear housings or frames) are subject to distortion if clamped with the same force as solids (such as gear blanks). Power chucks are particularly apt to cause this difficulty. Such distortion may be entirely within the elastic range or involve both a recoverable elastic movement, plus an unrecoverable plastic change. In the first case, the casting returns to normal dimensions when unclamped, but the machining performed while it was clamped may no longer be true. In the second stage, both the machined and unmachined portions of the casting will be distorted.

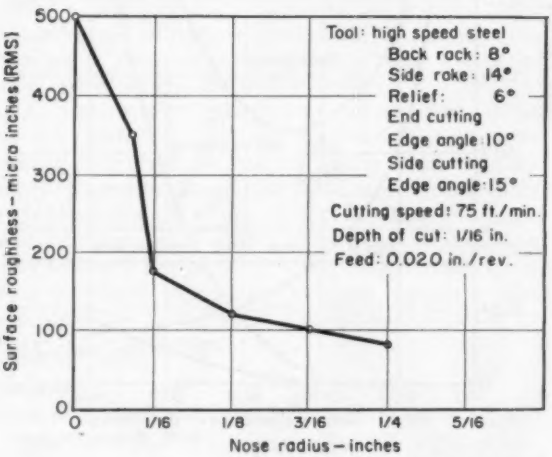
Most iron castings are relatively free from internal stresses as cast. Others may contain low to high internal stresses as cast. If the casting contains internal stresses and a machining operation removes some of the stressed metal (outer surfaces are generally the more highly stressed), the casting will move or change shape to rebalance the internal forces. For this reason, some castings which are subject to internal stresses and require accurate machining should first be given a stress-relieving heat treatment. Others may be satisfactorily machined to close tolerances by completing all the roughing cuts before the light finish cuts are started. When heavy machining and precise dimensions are both required, it is occasionally desirable to relieve internal stresses by heat treatment between the rough and finish machining operations.

The geometry of some castings may be such as to require extremely light cuts to avoid distortion from cutting forces. The heat of cutting, particularly with a dull tool or heavy depth of cut, can cause temporary distortion of the work through thermal expansion. The machine work performed while the casting was differentially heated may not remain true when it has returned to normal temperature.

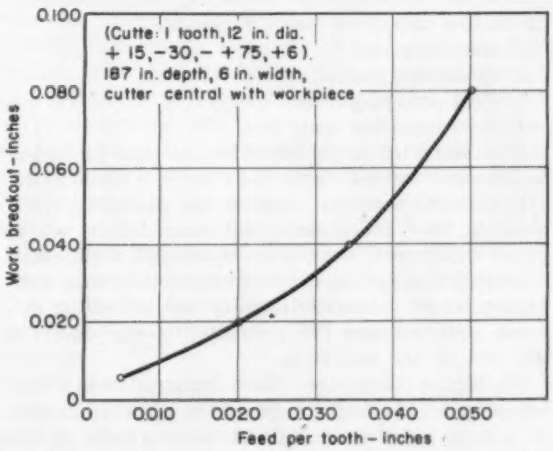
Coolants—Usually cast iron is machined dry except for cutting operations such as threading. The powdery portion of iron chips forms a slurry with cutting fluids, and with the ordinary fluids this may cake in the grooves and crevices of the machine tool. Detergent emulsions have been developed specifically for use as coolants in machining iron castings. There is little tendency for rusting or clogging to occur with these fluids, and they have been beneficial to tool life.



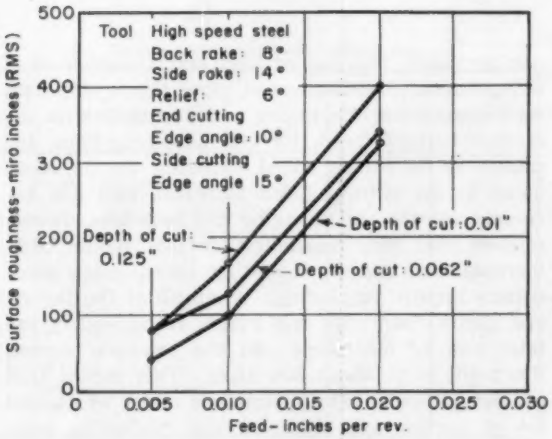
Surface finish . . .
is influenced by microstructure and cutting speed. Finer graphite, a harder matrix, and higher speed each contribute to better finish



Nose radius . . .
of the tool influences finish. This trend is typical


(Cutter: 1 tooth, 12 in. dia.
+ 15, −30, − + 75, +6).
187 in. depth, 6 in. width,
cutter central with workpiece
Work breakout—inches
Feed per tooth—inches

Work breakout . . .
is influenced by feed in milling or planing. Microstructure and cutting force are other important factors



Effect of feed . . .
and depth of cut on work finish

Tool life curves courtesy USAF Machinability Report

HOW TO MACHINE GRAY AND NODULAR IRON . . .

ECONOMICS OF MACHINING

In any machining operation, it is desirable that the production rate should be balanced against machining cost. This is particularly important in large production operations. Conditions should be selected so that the desired production rate is obtained at the lowest overall production cost. When the economical rate of production in the machine shop greatly exceeds the desired production rate for assembly or shipping, the item is usually processed in lots and supplied from stock. The selection of the most economical lot size is often a complex decision involving a number of factors such as interest on investment, cost of storage space, and possible obsolescence, as well as the comparison of setups on different types of machines. When determining the economic lot size for machining, the cost of the castings should also be considered, since their price may vary with order quantity.

The cost factors in all machining operations may be classed into four major factors:

1. Idle time cost
2. Machining costs
3. Tool changing costs
4. Tool repairing costs.

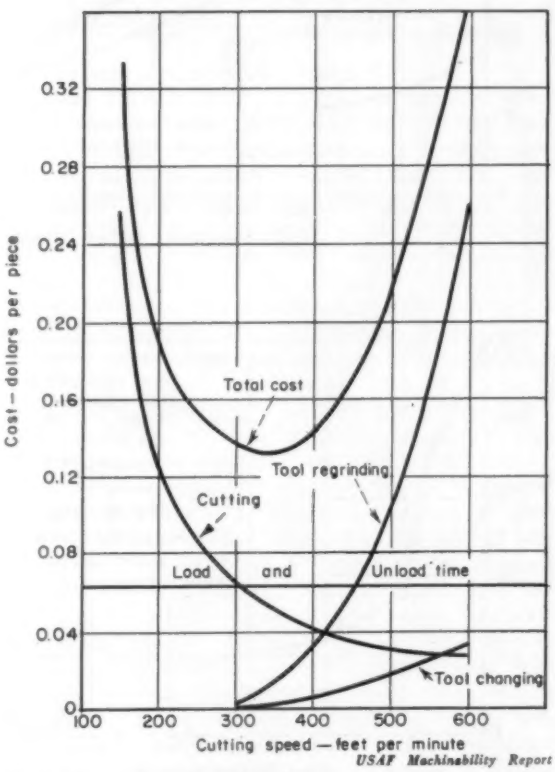
The idle time costs take into account the labor and burden rates on a machine while it stands idle. This consists of set-up, loading and unloading time, cleaning time, oiling time, and other factors which cause equipment to be idle in normal production. Anything that can be done to reduce this time, such as the use of automatic loading and unloading devices, will increase the productivity and decrease the cost of the operation.

Machining costs are those incurred while the equipment is actually engaged in cutting. Hence, it is made up of the labor and burden rates on the machine and takes into account the labor to machine a single piece. This time consists of feeding time, including time of approach, and overtravel.

The tool changing costs include the time required to change tools and cutters. This cost is figured as labor and burden on the machine during tool changing. Quick-change tooling or cartridge-type toolblocks can aid in decreasing this cost.

Finally, there is the tool repair cost. This includes the time to rebraze or reset, as well as to regrind tools (with a material and a burden charge for the toolroom).

When these four cost factors are plotted against



Influence of cutting speed . . .
on the four factors of cost and on total cost. This is a typical example, not a general standard

cutting speed, the cost of load and unload time is independent of cutting speed, since this is idle time for the machine. Machining cost decreases with increased cutting speed, for the machining time decreases as the cutting speed increases. On the other hand, as the cutting speed increases, tool life decreases and the tool changing cost increases. It also follows that tool regrinding or tool repair costs increase with increased cutting speed, since more cutters require regrinding. When all of the factors are summarized into one curve, it represents the total cost of machining. In the example shown, the point is at about 350 sfpm. This means that for the particular set of conditions under which this set of curves was obtained, the machining costs

will increase when the speed is other than 350 sfpm. However, it may not be feasible to use this speed, as production requirements and the availability of capacity may dictate other conditions, at a sacrifice in actual machining cost.

As an example, consider a cutting speed 50% greater than that at which the minimum cost occurred. According to the example the cost of machining a piece at 525 sfpm would be about 25¢, as compared to 13¢ at the cutting speed of 350 sfpm. The requirements of the job may justify this increased cost, if the increased speed provides the means of meeting a delivery schedule.

Up to now consideration has been given primarily to cutting speed. It is equally important to select the proper feeds. Usually, one finds that high production at minimum costs can be obtained by using as high a feed as possible, consistent with the rigidity of the workpiece and the finish and accuracy requirements.

GENERAL MACHINING RECOMMENDATIONS

As a basis for general machining recommendations, four characteristic matrix structures have been selected from the continuous series of microstructures which are available in iron castings.

Obviously, a single recommendation, even for a specific material, cannot provide for the possible variations due to work shape, machine characteristics, or operator skill. Single values or reasonable ranges were considered preferable to ranges wide enough to cover all contingencies, since the practical use of either required experience.

As a guide, the typical hardness ranges are given in the table for each of the four characteristic matrix structures selected for general recommendations. Three ranges of hardness are given for each, depending upon the type of iron in which it occurs, since differences in analysis and graphite structure also influence hardness. It is well to point out again that a direct correlation between hardness and machinability is not valid without consideration of these other variables.

TURNING

Speeds, feeds, and tool angles are shown in tables.

Tool material—The cobalt type of high-speed-steel tool is preferred over regular high-speed steel for the high-strength or alloy irons. High-speed steel can be used most satisfactorily on the lower-strength gray irons. In the carbide tools, the straight tungsten-carbide type is best.

Turning Speeds and Feeds for Gray Iron

MATRIX	SPEEDS, sfpm HSS	Cast Alloy	Tungsten Carbide
1. Ferrite (fully annealed)	150	350	800
2. Coarse pearlite or pearlite and ferrite	100	125	300
3. Fine pearlite	80	100	250
4. Acicular (alloy or heat-treated)	30	60	125
For all types (varies inversely with speed)	Feeds ipr .015 to .025	.015 to .020	.020 to .035

Cutting fluids—Because of the powdery nature of chips there is a tendency for them to rust when an ordinary coolant is used in the machining of cast iron. Generally, cast iron can be machined satisfactorily dry. This is particularly true with carbide tools. However, if a hard or high-strength iron is being machined, a water-base, chemical type of cutting fluid intended for use with cast iron can be of considerable advantage.

Power requirements—The power in terms of horsepower required to remove metal at the rate of one cubic inch of metal per minute is most applicable in determining the size of machine required. The size of motor to perform a specific cut with a sharp tool can be based on 0.8 hp/cu in./min for as-cast irons and 0.5 hp/cu in./min for fully annealed irons. However, when the tool dulls, the power requirements will double, and hence in order to insure adequate power throughout the life of the tool, the size of the motor should be based on these requirements for feeds in the range 0.010 to 0.020 ipr:

1.6 hp/cu in./minute for as-cast irons

1.0 hp/cu in./ minute for fully annealed irons

The values should be 20% higher for feeds of less than 0.010 ipr and can be 10% less for feeds over 0.020 ipr.

Example of hp calculation

Hp of motor = feed/rev × depth of cut × 12 × cutting speed × hp/cu in./min.

The factor of 12 converts speed from fpm to ipm. For a 0.150 in. depth of cut, 0.015 in. feed and a cutting speed of 300 sfpm (carbide tool—coarse pearlite) on an as-cast iron, the motor size should be:

$$\text{Hp of motor} = 0.015 \times 0.150 \times 12 \times 300 \times 1.6$$
$$= 13 \text{ Horsepower}$$

MILLING

Feed—The feed rate recommendation in a milling operation is usually given in terms of inches per tooth; however, on the milling machine the feed dial reads in inches per minute. In order to convert

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Tool Angles for Turning Gray Iron

Tool Angles	HSS & Cast Alloy	Carbide	
		Brazed	Inserted Tip
Back Rake	0	0	−7
Side Rake	+10	+6	−7
Side Cutting Edge Angle	+15	0	+15
End Cutting Edge Angle	+15	+6	+15
Primary Relief	+7	+6	+7
Secondary Relief	+10	+9	—
Recommended Nose Radius			
Depth of Cut	**HSS and Cast Alloy**	**Carbide**	
1/8 in. or less	1/16	1/32	
1/8 in.-3/8 in.	3/32	3/64	
7/16 in.-3/4 in.	1/32	1/16	
13/16 in.-1 1/4 in.	1/8	3/32	

Milling Speeds for Gray Iron

Matrix	HSS sfpm	Carbide sfpm
1. Ferrite (fully annealed)	180	600
2. Coarse pearlite or pearlite and ferrite	100	320
3. Fine pearlite	75	270
4. Acicular (alloy or heat-treated)	40	170

Milling Feeds for Gray Iron

Type of Cutter	HSS ipt	Carbide ipt
Face Mill	.010 to .015"	.012 to .020"
Slab Mill	.008 to .012"	.010 to .016"
End Mill	.006 to .008"	.007 to .010"

the feed from inches per tooth to inches per minute, it is necessary to know the number of teeth and the rpm of the cutter.

Inches per minute = rpm × number of teeth × inches per tooth

Tool material—High-speed steel is often used in such milling cutters as helical and end mills and form-relieved cutters, while carbide is widely used in face milling.

Tool angles are shown in the table. In addition to changing the tool angles as shown to reduce excessive breakout, repositioning the cutter relative to the work may also prove beneficial. A separate finishing cut is usually the best solution to obtaining a good finish, small breakout, and required accuracy.

Power requirements—For feeds of 0.005 to 0.020 ipt, the power requirement at the motor throughout the life of the cutter is:

1.5 hp/cu in./min for as-cast iron

0.9 hp/cu in./min for fully annealed iron

It should be noted that the power requirements increase as the width of cut in face milling or depth of cut in peripheral milling is increased.

An example of selecting the size of the milling machine for a specific job follows. The job requires:

Feed: 0.015 in./tooth

Cutting speed: 320 sfpm (carbide cutter—coarse pearlite iron)

Depth: 0.200 in.

Cutter: 8 in. diameter—10-tooth face mill

Width of cut: 3 in.

$$\text{Rotational Speed} = \frac{12 \times \text{cutting speed}}{\pi \times \text{dia of Cutter}}$$

Tool Angles of Face Mills for Gray Iron

Tool Angles	HSS	Carbide
Axial Rake	10°-15°	4°-6°
Radial Rake	10°-15°	4°-6°
Corner Angle	0° (1/16" chamfer)*	0° (1/16" chamfer)*
Primary Clearance Angle	4°-6°	3°-6°
Secondary Clearance Angle	8°-10°	8°-10°
*With heavy feeds, at 45° or 60°, corner angle is often used to prevent excessive breakout at the edges. In conjunction with this, the following angles are used:		
Axial Rake	+20°	−5°
Radial Rake	−5°	−5°

Drilling Speeds and Feeds for Gray Irons

SPEEDS		
Matrix	HSS sfpm	Carbide sfpm
1. Ferrite (fully annealed)	120	200
2. Coarse pearlite or pearlite and ferrite	90	175
3. Fine pearlite	70	150
4. Acicular (alloy or heat-treated)	50	100
FEEDS		
Drill Size	HSS and Carbide Feed, ipr	
1/8	0.002	
1/4	0.005	
1/2	0.012	
1	0.015	

Reaming Speeds and Feeds for Gray Iron

SPEEDS		
Matrix	HSS sfpm	Carbide sfpm
1. Ferrite (fully annealed)	90	200
2. Coarse pearlite or pearlite and ferrite	75	140
3. Fine Pearlite	60	120
4. Acicular (alloy or heat-treated)	50	80
FEEDS		
Reamer Size	Feed, ipr	
1/4 in. or less	0.005 to 0.010	
1/4 to 1/2	0.010 to 0.020	
1/2 to 1	0.020 to 0.030	
1 to 2	0.030 to 0.100	

$$\frac{12 \times 320}{\pi \times 8} = 153 \text{ rpm}$$

Nearest speed available on machine = 160 rpm

At 160 rpm, cutting speed $= \frac{8 \times \pi \times 160}{12}$

$= 335$ sfpm

Table feed in inches per minute to get a feed of 0.015 ipt = rpm × number of teeth on cutter × feed per tooth = 160 × 10 × 0.015 = 24 ipm

Available table speed nearest 24 ipm = 22 ipm at

22 ipm feed $= \frac{22}{10 \times 160} = 0.014$ ipt

Power Requirements = cu in./min × hp/cu in./min

= in./min × depth of cut × width × hp/cu in./min

= 22 × 0.200 × 3 × 1.5

= 19.8 hp required at motor

DRILLING

Types of tools—High-speed steel drills are most widely used. Cobalt high-speed steel is often selected for the harder cast irons. Solid carbide drills in small sizes and carbide-tipped twist drills are now more common. Carbide drills are somewhat limited, because they require more attention in handling and sharpening and also because they are several times as expensive as HSS drills. Very often a carbide drill is made by simply inserting a carbide tip in the end of a conventional high-speed-steel twist drill. Carbide drills are particularly suitable for drilling out cored holes.

Tool angles—118° point angle, 32° helix angle.

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Cutting fluid—Dry (water soluble cutting fluid is often used in production drilling)

Power requirements—The horsepower required at the motor per cubic inch of metal removed per minute is:

0.60 hp for feeds over 0.010 ipr
0.75 hp for feeds under 0.010 ipr

Note that at the lighter feeds, the power requirements per cubic inch of metal removed per minute are greater than at the heavier feeds.

Example: Determine the size of motor required to drill a ½-in. diameter hole at a feed of 0.012 ipr and a drill speed of 90 sfpm in as-cast iron, coarse pearlite.

At a cutting speed of 80 sfpm, rpm =

$$\frac{12 \text{ cutting speed}}{\pi \text{ d}} = \frac{12 \times 90}{\pi \times \frac{1}{2}} = 686$$

Available rotational speed = 640 rpm

Rate of metal removal =

$$\frac{\pi}{4} \times d^2 \times \text{feed/rev} \times \text{rpm} =$$

$$\frac{\pi}{4} \times (\tfrac{1}{2})^2 \times 0.012 \times 640 =$$

1.5 cu in./min

At a feed of 0.012 ipr, the power requirements are 0.60 hp/cu in./min

Power Requirements – 1.5×0.60
$= 0.9$ hp required at motor

MULTIPLE-FLUTE REAMING

If feed is too low, glazing, excessive wear, or chatter may occur.

Tool material—High-speed steel is most widely used in reamers, but carbide-tipped reamers are also used, particularly in high production or with the types of iron more difficult to machine. It is especially important that no chatter exist when carbide reamers are used.

Stock for reaming—If insufficient stock is allowed, burnishing may occur. Allow the following stock:

0.005 to 0.008″ up to 1″ diameter
0.008 to 0.015″ – 1″ diameter and larger

Power Requirements—Power requirements are not usually important in reaming since the stock removal is low. However, rigidity and alignment are extremely important for accuracy and satisfactory finish with reasonable tool life.

TAPPING

Types of Tools—High-speed-steel taps are recommended for tapping cast iron.

Tool angles—A 0° rake angle is usually used, although a rake of 3 to 5° is often better for annealed cast iron.

Cutting fluid—A sulphur-base oil is recommended in tapping.

Power requirements—The power requirements are as follows:

0.20 hp for ¼-in. tap
0.50 hp for ½-in. tap
1.5 hp for ¾-in. tap

Tool Angles for Reaming Gray Iron

	HSS	Carbide
Chamfer	45°	30-45°
Clearance	3-7°	6-8°
Rake	0-5°	4-7°
Land	0.008-0.015″	0.007-0.020″

Tapping Speeds for Gray Iron

Matrix	HSS sfpm
1. Ferrite (fully annealed)	50
2. Coarse pearlite or pearlite and ferrite	35
3. Fine pearlite	30
4. Acicular (alloy or heat-treated)	25

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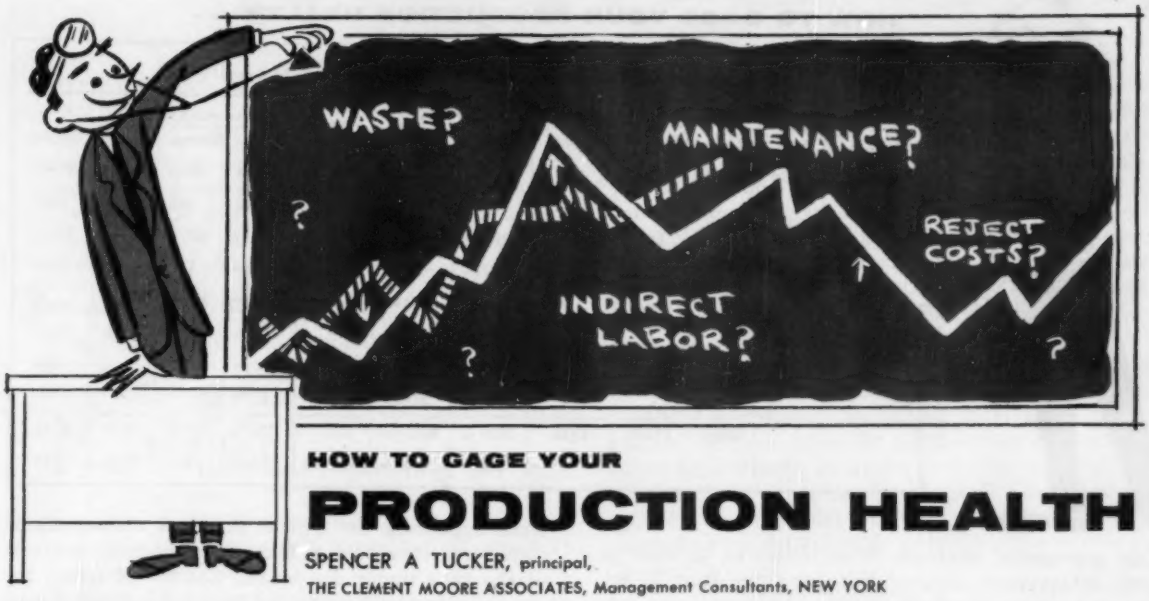

HOW TO GAGE YOUR

PRODUCTION HEALTH

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Management is as much a part of production as machining or maintenance. But in many small plants (especially in job shops, where the need is so great), management controls have not progressed as rapidly during the past few years as other aspects of production. This article—the third in a continuing series on small-plant management—suggests that time reports and profit-and-loss statements are not sound barometers, and explains 16 control ratios that can be established from the various aspects of production. These ratios, properly applied, should make you your own production consultant

Management problems are wider in scope and more complex today than twenty years ago. Once one of the best ways to keep abreast of a competitor was to effect savings (and increase profits) by controlling operating expenses closely. Some companies, for instance, were able to survive because they developed more efficient materials-purchasing methods, thus placing profit potential in the materials-cost segment of operating expenses. But today operating costs of most metalworking plants are controlled so closely that a search for other areas of profit is mandatory.

Big business constantly explores avenues of profit potential. Large companies hire permanent staffs of specialists to analyze future profit-making opportunities, and can budget their finances to bring to fruition any feasible long-range plan. The small company, operating without these benefits, may soon find itself losing sales to a better-equipped competitor who is able to make accurate managerial decisions and to reduce internal costs. Even among small companies competing with each other, there are large variations in volume and profits, because some will have more competent managements and better managerial data than others.

Formerly one company could out-smart a rival by converting, say, from toting by hand to conveyors. Today even the most elementary managerial practice recognizes the need for as much mechanization as its company's capital structure will allow; thus serious competition rarely takes place in this area. Instead, opportunities for profit and growth exist in more subtle areas that often escape the attention of busy management, thereby draining off potential profits that could be better used elsewhere.

Assuming that such factors as machinery costs, power and rental costs, hourly rates for direct labor, and cost of raw materials are the same for an industry, and that geographical conditions are similar, then the leverage for reducing costs and increasing profits can be found in the following areas:

- High direct-labor utilization
- High materials utilization
- Minimum necessary supporting expenses
- Increased sales and markets

The first step above is accomplished by increased productivity, and the second by quality control, waste control, and proper production engineering. The third and fourth steps, however, have elusive qualities sometimes difficult to assess or improve. And before any action can be taken in these areas, management must know how and exactly where to take it. This calls for rapid and believable information that depicts the true situation at any moment.

But this is control only of the immediate: An event occurs, management is advised, management compares, and then management acts. This is goal number one for managerial control: *Immediate management action on present targets to correct a current situation.*

When managerial controls extend beyond the immediate, so that future economy is affected, more scientific tools must be used. *Management should design its long-range competitive picture today:* This is certainly goal number two for managerial controls. The subject is complex conceptually and mathematically, especially if a highly refined program is desired. Here the techniques of what has come to be known as Operations Research are employed, which allow management to make better, more objective decisions than are possible with emotional or instinctive guidance. This subject will be treated separately in the final section of this series

TABLE I: Example of a Condensed Payroll-Analysis Summary

No. of Employees	Base Rate	Hours Worked	Base Salary	Overtime Premium	Direct Labor		Earned Hours	Indirect Labor			Subsidy
					On Std	Off Std		Maint.	Reproc.	Setup	
25	$1.20	1100	$1320	$60	600 hr	400 hr	105	40 hr	40 hr	20 hr	25 hr
					$720	$480	$126	$48	$48	$24	$30
15	$1.30	700	$910	$78	200 hr	300 hr	28	120 hr	40 hr	40 hr	10 hr
					$260	$390	$36.40	$156	$52	$52	$13
35	$1.80	1400	$2520	0	800 hr	400 hr	120	20 hr	80 hr	100 hr	0
					$1440	$720	$216	$36	$144	$180	20 hr
25	$2.20	1200	$2640	$220	200 hr	900 hr	25	100 hr	0	0	$44
					$440	$1980	$55	$220			
100		4400	$7390	$358	1800 hr	2000 hr	278	280 hr	160 hr	160 hr	55 hr
					$2860	$3570	$433.40	$460	$244	$256	$87

on managerial controls. What concerns us now is the achievement of Goal Number One—How to act on immediate problems.

PROFIT-AND-LOSS STATEMENTS

Most managements are willing to act upon information prepared specifically for their use. The soundness of the information, its form, and the method by which action results from this data are all factors around which the control problem revolves. Too often in small and medium-sized businesses, managing consists merely of reviewing the profit-and-loss statement. Unfortunately, this information does not set clear targets for remedial action and does not provide the dynamics of what has happened in the previous period.

The statement actually is a lumping together of various account data that tells what happened in production after it happened. Because it is not designed to expose the transient peaks and valleys of company economy, management loses the opportunity to trouble-shoot. By its very nature, the P & L statement smoothes out these irregularities and hides the profit leaks that management ought to know about, and must know about constantly. A P & L statement is a must for many reasons, but employing it as a management operating tool amounts to superficial action *after* the facts, using ancient history.

A typical method of those who use the profit-and-loss statement as a managing tool is to assign to each expense its equivalent percentage content in the sales dollar. This procedure is academic and useless if the company has a variable product mix, where several products are made and where the percentages for direct labor, material, and overhead are characteristically different. In many companies an increase in direct-labor percentage over the previous period is cause for dismay, in spite of an actual, unexplained improvement in economy irrespective of the higher direct-labor content. What might have happened here is simply that more items were produced which required more direct labor per sales dollar, so that the *average* direct-labor figure on the P & L statement was increased.

Dynamic, non-accounting managerial controls deal with integrated or inter-related information. Data appearing on typical financial statements is considered unrelated, at least for managerial controls of the type under discussion. Control of labor, for example, cannot be obtained by knowing that a man turned out 1000 pieces or earned $75—for these are unrelated data abstracted from records. The information does become vital when that effort and pay are related to the rate at which the work was produced. If the data shows that the man produced 1000 pieces *per hour*, we are then in a position to evaluate productivity, the economy of labor, and costs.

You might think that the direct-labor segment of a P & L statement is integrated data, because it can be related to the sales dollar. This is fallacious, for the sales dollar has various "colors," depending on the specific product involved; that is, we expect the direct-labor component in the sales dollar to change for different products. In a production tool and die shop, direct labor is expected to be higher than it is in a punchpress shop, and the same principle can be carried into the various processes within a given company. The hour, however, is a firm base, and irrespective of the product its value is always 60 minutes. (For more information on economy as a function of product mix, see *AM*—Feb 25 '57, p132.)

Before we proceed to the specifics of managerial controls, one fact warrants attention: The success of any set of managerial controls depends on people, for it is people who implement management directives, and it is people (not things) who are being controlled. When an expense is reduced, a new product developed, another market opened, or a risk lowered, it is the human being who is controlled and through whom the result is obtained.

All control systems depend on reducing to writing, on a standard form, information required. This information may be of the primary type, that is, a report of events at the scene of action with each event unrelated to the others, such as total production output or cash in the bank. It may be of the secondary type, as when two pieces of primary information are related to each other: turnover of working capital, average productivity, or any other data not taken directly from the scene of action. Two other types will be described in future articles: a third type, where pieces of secondary information are inter-related; and a fourth type, where tertiary

data is used to extrapolate other information that could involve the basis for future decisions.

In the managerial control of factory economy, two pieces of information are required that fall into the primary and secondary types. The first is an accurate system of time and production reporting from the shop; the second is a payroll analysis from which certain control ratios can be developed.

TIME AND PRODUCTION REPORTING

Time and production reporting should be performed daily by production and non-production people, and should list the following:

- Date, name of operation, department, and space for foreman's okay
- Name of operation(s) performed for each quantity shown
- Quantity produced for each operation
- A code number linking production to some sort of control
- Elapsed time for the operation(s)
- Explanation for downtime, and the elapsed time
- Number(s) of the machine(s) or production center(s) where work was performed

Proper time reporting takes into account the entire production time, even though part of that time may be spent in waiting for materials or for a machine to be repaired. For completeness, and particularly for habit, even mechanics should fill out daily time tickets. Standard symbols or numerals will minimize writing problems.

These tickets are designed to describe any of several situations. They may apply to the operator, the machine, or the job, depending on the product and scheduling system in force. They may, for instance, tell the time required (1) for a group of operations comprising one production, (2) for an operator to do a prescribed job, (3) for a job to be done, (4) for an operator to run a machine, or (5) for a machine to do a job. These tickets, in other words, provide material for analysis of the operator, the job, and the production unit. However, they do not furnish an evaluation of departmental or plant economy unless summarized and compared. For this information a payroll analysis is needed.

Payroll analysis is simply an extension of the payroll journal, which distributes time and money among various cost elements of production. Table I shows a condensed payroll-analysis summary.

Without this analysis, the payroll is simply a collection of unrelated facts. The dollars and hours are not related to each other and to other standards, and making a decision from these facts alone fails to show their real effect on plant economy. That gross payroll increased from the previous week or that maintenance manning decreased is not necessarily evidence of a change in internal economy. *What is significant is the extent to which relative or unit expenses changed.*

Table II, which makes use of the figures given in Table I, shows unrelated payroll data.

YARDSTICKS OF PERFORMANCE

As we have seen, analysis of unrelated or primary data cannot result in effective control of plant economy. What is important is the inter-relation of the many factors that make up plant economy. One way to attack the problem is to establish ratios between these factors; in this way comparisons can be made between, say, one week's ratio and that of a following week. If we establish a whole family of ratios, we can discover what production relationships are improving or weakening—all on a weekly basis. This picture of course does not give the whole story, for such data is on an elementary level and can really be considered unrelated to the company's *total* economy, which includes sales and capital investment as well as production.

TABLE II: Unrelated Data from a Weekly Payroll-Analysis Summary

1.	Total Gross Payroll	$8181.40
2.	Total Gross Hours Worked	4400
3.	Total Overtime Premium Paid	$ 358
4.	Total Clock (Elapsed) Hours of Direct Labor	3800
5.	Clock Hours on Incentive Direct Labor	1800
6.	Clock Hours on Non-Incentive Direct Labor	2000
7.	Total Paid Direct Labor	$6430
8.	Total Pay, Clock Hours of Direct Labor on Incentive	$2860
9.	Total Pay, Clock Hours of Direct Labor on Non-Incentive	$3570
10.	Total Incentive Premium Paid	$ 433.40
11.	Total Incentive Hours Earned Over Clock Hours on Incentive	278
12.	Total Indirect-Labor Hours	600
13.	Total Indirect Labor Paid	$ 960
14.	Indirect Labor Paid for Maintenance	$ 460
15.	Indirect Labor Paid for Reprocessing	$ 244
16.	Indirect Labor Paid for Setup	$ 256
17.	Total Subsidy Cost	$ 87

Unrelated Data from Other Sources in the Same Period

100.	Available Manufacturing Square Feet	30,000	(fixed item)
101.	Billings in Period	$34,000	
102.	Machinery-Repair Costs (excluding item 14 above)	$ 140	
103.	Dollar Value of Waste	$ 102	
104.	Cost of Rejects from Customers	$1260	
105.	Total Amount of Machinery Depreciated in Period	$ 600	(fixed yearly item)

TABLE III: Control Ratios Produced from Unrelated Data

A. Productivity Ratio	$\frac{5 + 11}{5}$	$= \frac{1800 + 278}{1800}$	$= 115.4\%$
B. Incentive Coverage Ratio	$\frac{5}{5 + 6}$	$= \frac{1800}{1800 + 2000}$	$= 47.3\%$
C. Performance Ratio	$\frac{5 + 11}{2}$	$= \frac{1800 + 278}{4400}$	$= 47.2\%$
D. Total Indirect-Labor Ratio	$\frac{13}{7}$	$= \frac{\$960}{\$6430}$	$= 0.149$
E. Excess-cost Ratio	$\frac{15 + 17}{7}$	$= \frac{\$244 + \$87}{\$6430}$	$= 0.051$
F. Billing-Payroll Ratio	$\frac{101}{1}$	$= \frac{\$34,000}{\$8181.40}$	$= 4.156$
G. Billing-Space Ratio	$\frac{101}{100}$	$= \frac{\$34,000}{30,000}$	$= 1.133$
H. Waste Ratio	$\frac{103}{101}$	$= \frac{\$102}{\$34,000}$	$= 0.003$
I. Reject Ratio	$\frac{104 + 15}{101}$	$= \frac{\$1260 + \$244}{\$34,000}$	$= 0.044$
J. Labor-Maintenance Ratio	$\frac{14}{1}$	$= \frac{\$460}{\$8181.40}$	$= 0.056$
K. Machinery Maintenance Ratio	$\frac{14 + 102}{105}$	$= \frac{\$460 + \$140}{\$600}$	$= 1.000$
L. Subsidy Ratio	$\frac{17}{1}$	$= \frac{\$87}{\$8181.40}$	$= 0.0106$
M. Quality Ratio	$\frac{103 + 104}{7}$	$= \frac{\$102 + \$1260}{\$6430}$	$= 0.212$
N. Incentive-Quality Ratio	$\frac{103 + 104}{5 + 11}$	$= \frac{\$102 + \$1260}{1800 + 278}$	$= 0.655$
O. Setup Ratio	$\frac{16}{7}$	$= \frac{\$256}{\$6430}$	$= 0.039$
P. Setup-Cost Ratio	$\frac{16}{101}$	$= \frac{\$256}{\$34,000}$	$= 0.0076$

The ratios are, however, valid yardsticks of production performance. Below are defined a number of the ratios, which will be used to correlate the unrelated (primary) data given in Table II into meaningful secondary data.

A. **Productivity ratio (up-good):** The percentage over or under the number of direct-labor hours established as standard under an incentive plan. This is a simple way to evaluate the efforts of workers on incentive operations. It also evaluates the fairness of production standards; a low percentage might be evidence that the standards are too high. (Table II: 5 + 11 ÷ 5)

B. **Incentive coverage (up-good):** The relationship of incentive direct-labor hours to total plant direct-labor hours (both incentive and non-incentive). Here is shown what portion of the total direct effort is standardized. If some sections of the plant are covered by incentives and others are not, this ratio can help, when it is compared with the same ratio from previous periods, to measure the effectiveness of incentive policing. (Table II: 5 ÷ 5 + 6)

C. **Performance ratio (up-good):** The relationship of total earned direct-labor hours under incentive work to total gross hours (including both direct and indirect labor) worked. This ratio shows the additional effort obtained by the incentive program and is a double check on the effectiveness of the Productivity ratio. Productivity percentage should always exceed Performance percentage; management's goal should be to have Performance approach Productivity as closely as possible. The two of course can never meet, because of the indirect labor in production. (Table II: 5 + 11 ÷ 4 + 12, or 5 + 11 ÷ 2)

D. **Total indirect-labor ratio (down-good):** The number of cents necessary to sustain each direct-labor dollar. (Table II: 13 ÷ 7)

E. **Excess-cost ratio (down-good):** Excess costs are compared here to the cost of direct labor. The ratio for this control would be zero if excess costs were really avoidable. This ratio states how much money is wasted on each dollar of direct labor. (Table II: 15 + 17 ÷ 7)

F. **Billing-Payroll ratio (up-good):** Used to confirm other data, this ratio compares total billings during a particular period with total payroll. Actually, the payroll period and billing period will not coincide. But because ratios thus produced are used as comparative data from one pay period to another, and because the time gap is approximately the same, the comparison is valid. (Table II: 101 ÷ 1)

G. **Billing-Space ratio (up-good):** This is a helpful, industry-wide ratio sometimes used in trade-association work. Management can use it as confirming data. Here is stated how much billing is produced from each square foot of manufacturing space; it is often the basis for expansion in terms of machines rather than space. (Table II: 101 ÷ 100)

H. **Waste ratio (down-good):** A good cost figure that is useful in estimating work, this ratio tells how many cents of waste should be added to each dollar of sales in an estimate. (Table II: 103 ÷ 101)

I. **Reject ratio (down-good):** The number of cents of total reject cost for every dollar of goods sold. (Table II: 104 + 15 ÷ 101)

J. **Labor-Maintenance ratio (down-good):** The

number of maintenance cents spent for every dollar of payroll. (Table II: 14 ÷ 1)

K. **Machinery-Maintenance ratio (down-good):** Here the cost of total machinery maintenance is compared with book depreciation in the same period. Table II: 14 + 102 ÷ 105)

L. **Subsidy ratio (down-good):** The number of cents spent to subsidize workers for every dollar of payroll spent. This control, when examined for individuals, provides managements with a rapid appraisal of their efforts to upgrade. (Table II: 17 ÷ 1)

M. **Quality ratio (down-good):** The relationship of waste dollars and cost of customer rejects to total direct-labor costs. This ratio reveals to what extent quality suffers with increases in direct labor. In effect, it shows whether production supervisors are capable of controlling expansions in their departments. (Table II: 103 + 104 ÷ 7)

N. **Incentive-Quality ratio (down-good):** The ratio of waste-and-reject costs to total incentive-based direct-labor hours. This relationship reveals how waste-and-reject costs vary with changes in productivity. (Table II: 103 + 104 ÷ 5 + 11)

O. **Setup ratio (down-good):** The number of setup cents spent for each dollar spent for direct labor. (Table II: 16 ÷ 7)

P. **Setup-Cost ratio (down-good):** The actual cost of setup in the sales dollar. (Table II: 16 ÷ 101)

These are but a few examples of the ratios that can be developed. Generally the data obtained from the ratios is compiled and posted across a single line on a managerial-control sheet. Each subsequent week's data is posted below, so that rapid comparisons of ratios during several periods can be made.

A comparison of ratios for successive periods may reveal that some have improved and some have not. There is some cause for joy if it can be proved that, in terms of dollars, the improved ratios offset the ones that have declined. In some instances, however, management would be happier with bad results in some ratios provided other ratios improved even slightly. In other words, these ratios cannot be weighted to each other linearly, until each is weighted to a common denominator or until they all are reduced to a dollar-and-cents value.

Some intercomparisons of factory economy are shown in Table III, which applies the figures given in Table II to various types of ratios. These can be of great benefit to the busy executive. If comparisons of ratios from period to period show sharp changes, then the individual control ratios can be consulted to pinpoint the chief trouble-producing areas. Note that the ratios developed cannot be compared to each other, nor do they have a direct relationship to any dollar. Rather, these figures are *indices* that move up or down from one period to the next, and as such are barometers of decline or improvement.

Note, for instance, that the ratio developed for machinery maintenance (Item K) has reached, at least for that particular week, the point at which the money paid out to keep the machine going is equal to the amount of book depreciation. If this ratio stays at this level, it is an indication that, from the tax standpoint at least, the machine should be replaced.

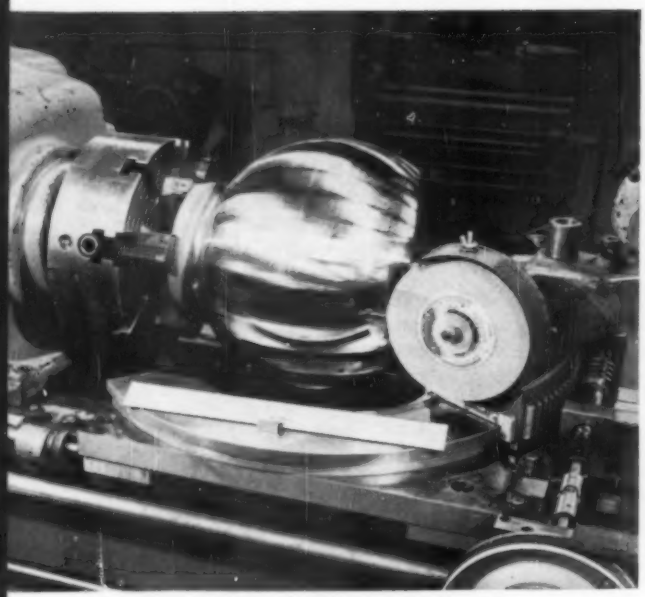
Another valid comparison is the relationship between the machinery maintenance ratio and productivity. Higher output from machines can increase wear and tear to the extent that expenses exceed production gains. Obviously, this comparison can enable management to fix machine speeds, by policy, at the highest *economical* limit.

Management should not make the mistake, however, of thinking that improved ratios automatically produce greater profits. Let us assume that records show a productivity rise from 80% to 120% on an operation during a certain period, and that the 50% productivity increase results from wage-incentive stimulus. If each hour of work (comprised of direct-labor and *fixed*-overhead expenses) costs $10, and the number of hours worked on incentive is 500, then the savings are 50% x 500 x $10, or $2500. But suppose that the 50% rise in productivity was brought about by only 10 hours of incentive work; here the savings would total only $50, a negligible figure. Thus management should not be fooled by high-productivity figures. Even the $2500 savings may be offset by additional costs: indirect-labor additions, higher waste figures, excess costs.

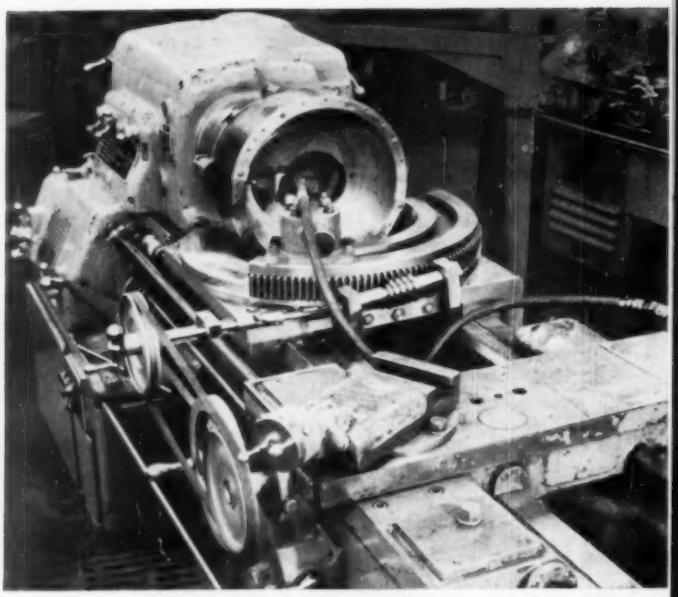
What is needed to control economy more closely is a tertiary type of control, which consists of composite ratios that are governed by several of the ratios developed in Table III. This third type of control, which is obtained by combining various of the earlier-developed ratios under a common denominator, is a refinement of Table III. How these composite ratios are developed, and what they will do to help management control factory economy, is the subject of the next article in this series.

Feedback Quiz

1. *Why is time reporting from the shop important?*
2. *Why isn't productivity a proper measure of shop economy?*
3. *Why is a payroll analysis important in the operation of your business?*
4. *Place the following in order of greatest quantity: Payroll dollar, Sales dollar, Direct-labor dollar.*
5. *Why is it uneconomical to allow normal yearly repairs on equipment to exceed the amount depreciated on your books?*
6. *If your payroll showed an increase in direct labor by 14% from the last week's level, what action would you take?*
7. *What is the difference between productivity and performance as used in this article?*
8. *Is it possible for the total output of a plant to increase in a week with a condition of lowered productivity during the same week?*
9. *In constructing a managerial control ratio, why wouldn't you use as one factor the number of people on the payroll?*
10. *If the indirect-labor ratio went from 0.18 to 0.20, is this evidence of improvement? Why?*



Spherical parts are turned and ground . . .
to close tolerances with the aid of this radius fixture. Here, a conventional toolpost grinder finishes a convex surface. Smaller wheels are used when grinding internal spherical surfaces

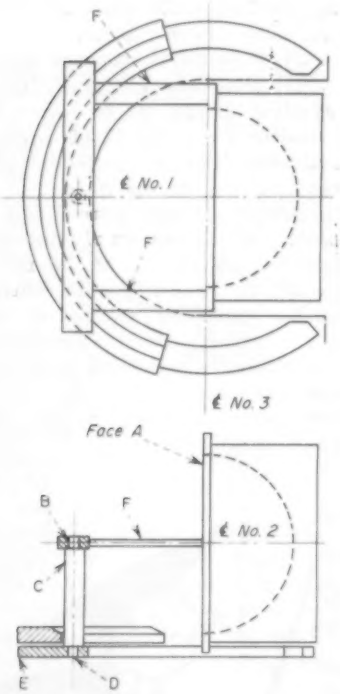


Cutting tool swings through an arc . . .
when worm gear drives geared segment of fixture. Power comes originally from cross-slide shaft and is transmitted to worm-gear shaft by V-belt

Novel radius fixture

When conventional radius devices couldn't hold close enough tolerances, Argonne developed this one. With solid supporting members and built-in provisions for centering, it meets tolerances of 0.0005 in. and 15 mu-in. on spherical parts

HERBERT V ROSS, superintendent of shops
and ALEXANDER A DENST, general foreman
ARGONNE NATIONAL LABORATORY

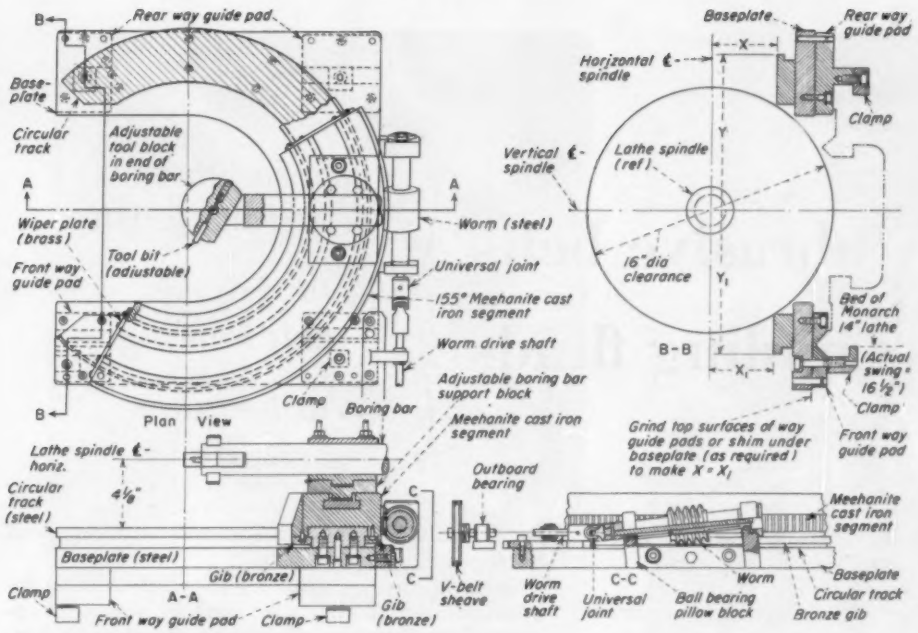


Fixture must be aligned
with centerlines 1, 2, and 3. For No. 3, a known point on the fixture is positioned a known distance from face *A*, thus: gage bar *B*, pivoted on top of pin *C* in hardened steel bushing *D* in baseplate *E*, is butted against two equal gage blocks *F* held against opposite sides of face *A*

Recently the Central Shops at the Argonne National Laboratory were called upon to machine and finish to close tolerances the spherical members of several large universal ball joints needed for a vacuum system. Even though these joints are sealed with large synthetic-rubber O-rings, it was necessary to hold the internal and external surfaces to precision dimensional tolerances, and to finish the surfaces smoother than 15 mu-in.

Previous attempts to machine and finish spherical surfaces with conventional turning devices, in which the tool holders were pivoted from central pins in the fixtures, had not been considered successful. Therefore, for this job, it was decided to design and construct a novel fixture in which a circular track provides adequate support for the tool while guiding it in the required arcuate path.

With this fixture, the lathe operator has experienced no difficulty in turning, boring, and grinding spherical surfaces 3 to 16 in. in dia. Travel of the tool-supporting segment on the circular track is 135° with one setting of the tool. An additional 120° of traverse can be achieved by repositioning the



Design of universal radius fixture . . .
provides adequate support for cutting tools or grinders

meets close tolerances

segment, resetting the toolpost on its top face, and then continuing the cut. A complete sphere can be turned, except for the portion of its surface by which the workpiece is chucked.

No difficulty has been experienced in holding the workpieces shown within 0.0005 in. of specified dimensions. Toolbit support is sufficient to prevent chatter during any of the turning, boring, or grinding cuts yet taken. And, with the toolpost grinder set up as shown, it has been an easy matter to produce finishes much finer than the 15 mu-in. maximum allowed.

The fixture consists of a precisely machined steel baseplate mounted in alignment with the lathe spindle on four guide pads fitted to the ways of a 14-in. Monarch engine lathe. A circular track is located accurately on the lathe centerline and is doweled and bolted in position. Toolholders or grinders are mounted on an arcuate Meehanite CI segment machined to fit the circular track with a clearance of 0.002 in. Arcuate bronze gibs hold the Meehanite segment in place on the track.

Gear teeth cut in the outer face of the traversing segment mesh with a steel worm for power feed around the circular track. The worm is mounted between ball-bearing pillow blocks on the baseplate and is connected through universal joints with a drive shaft and V-belt sheave.

Power for driving the worm is obtained from the crossfeed screw in the lathe carriage, the screw having been disconnected from the cross-slide. This makes possible a wide range of traversing feeds for the tool-supporting segment.

An important feature of the design for this fixture is the provision for precisely centering the fixture and the tool with the workpiece surface to be machined. Centerline No. 1 (sketch, p158) is no problem, because the guide pads ride the machine ways, and no lateral motion is possible. Centerline No. 2 is a known distance above the top of the circular track. Thus the cutting edge of the tool can be correctly located for height with the aid of gage blocks and a dial indicator on a height gage. Then the center point of the circular track must be positioned on the center of the arc which is going to be cut in the workpiece—represented by centerline No. 3.

For concave surfaces the alignment is performed as described in the sketch. Following this, the tool is set for the cut by advancing it beyond the center point or by offsetting it radially about the toolpost, according to calculated values.

For turning or grinding convex surfaces, centerline No. 3 is found by mounting a dial indicator on the toolpost and then traversing the indicator around the workpiece, while moving the fixture along the lathe bed until the center is found. Then the fixture is clamped in place on the machine, and the cutting tool or grinder is advanced to cutting position.

Why abrasive belts need grinding fluids

1.. to improve surface finish

2.. to reduce belt loading

3.. to lengthen belt life

J J DURNAN, eastern product engineer
BEHR-MANNING CO, TROY, NY

Two kinds of grain wear are characteristic of abrasive belts. Fracture occurs when the grains break open, exposing new sharp cutting edges. Attrition is the result of friction against the work metal, which dulls and flattens the grains. Ideal cutting conditions exist when there is slight attrition, then fracture, more slight attrition, more fracture, and so on.

Wear is important to abrasive-belt grains because the belt cannot be removed from the machine and resharpened accurately, as can most cutting tools. The grains are randomly arranged, and cutting angles are haphazard. Resharpening occurs only when the grains are worn by the work, which is in turn cut by the grains. Therefore, because cutting angles cannot be controlled, it is all the more important that the controllable cutting factors—belt speed, pressure, resharpening rate—should be closely watched.

Welding is a prime factor in belt grinding. Bits of work metal, under conditions of dry heat, can become welded to the abrasive grains, where they increase friction between the belt and work and lead to more heating and welding. Eventually a belt can become completely glazed and loaded this way. Welding reduces fracturing and increases attrition; a glazed belt cannot cut.

Here is where grinding fluids come in. Almost any fluid will help by providing a film between the belt and the work. Sharp grains will go through the film and do their cutting, but dulled grains will slip and slide—but not develop too much friction.

ACTIVE OILS

Welding between work metal and abrasive grains can best be prevented by using chemically active cutting oils, which contain compounds of chlorine, phosphorus, or sulfur, and are mixed with 50% or more mineral oil, plus additives. These form solid-film lubricants under heat and pressure. Welding is prevented partly because of the lubricants, and partly because the oil reacts slightly with the metal being machined.

Centerless belt grinders are the most common application for these oils, although they have been applied to other belt-grinding operations to raise production and increase belt life. They should not be applied when the work is copper or brass unless stains on the work are permissible.

Mixtures of mineral and lard oils have advantages because their cost is less than straight lard oil and their lubricating properties are better than straight mineral oil. They are non-staining, and can be blended to various mixtures for different applications. The harder the metal, the more lard oil should be added.

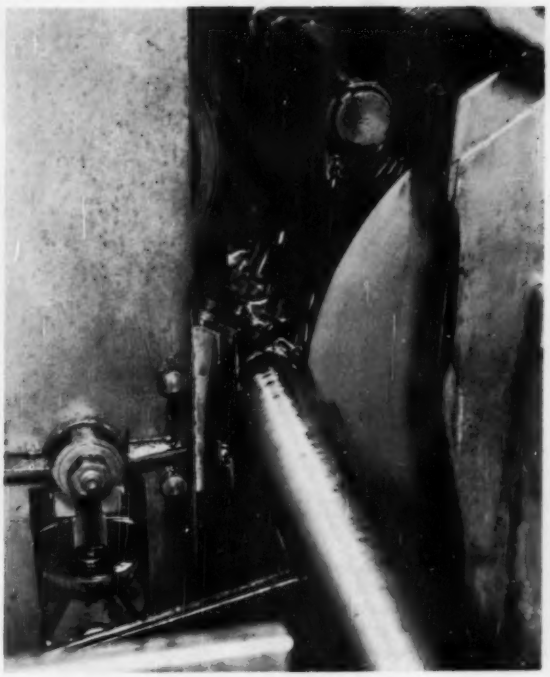
EMULSIONS

Mixtures of water and oil are effective because water itself will carry away more heat than any commercial coolant, and the addition of emulsified oil reduces the danger of machine or work rust. Water helps free particles from the belt as it works, which promotes cleaner cutting. Increasing the proportion of oil increases the cushioning effect, whereby the oil film resists grain penetration into the work. This improves surface finish on the work. With any emulsified oil a waterproof belt must be applied.

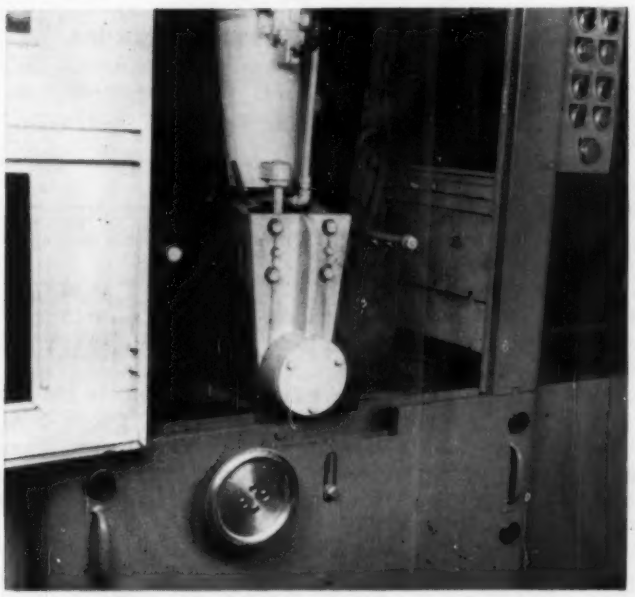
The same cushioning idea can be worked out if grease is applied to the belt. When a high surface finish is desired, a heavy grease will resist belt penetration into the work to provide a smoother finish. If heavy stock removal is the aim, a lighter grease can be applied. With either type the grease should have a low melting point—around 100 F—so it will flow uniformly over the belt. This will help prevent it from being thrown off at the idler wheels. Belts use greases with lower melting points than grinding or setup wheels because they run cooler.

A fairly new fluid is available for offhand polishing. Packed in a pressurized can, the new material is clean, economical, and convenient.

Flexible hose and drilled crosspipe...
deliver soluble oil to this belt. Note staying power of fluid, as above crosspipe. Machine has micrometer table stop and hydraulic control

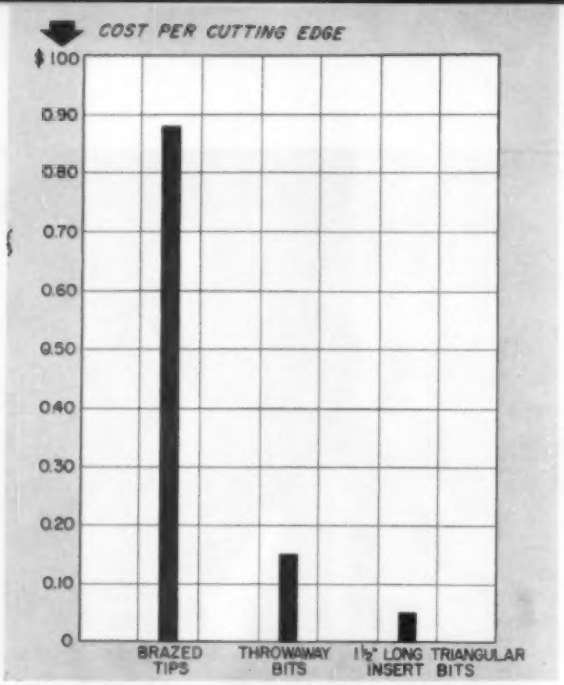


Centerless grinder uses...
chemically active cutting oil, which works as anti-weld agent on seamless steel tubing. Liquid also flushes and cools



Coolant sprays on belt...
of conveyorized sheet polisher, and belt carries it to the work. Filtering system reclaims fluid, as on wheel grinder

Stick lubricant is applied...
to yoke-sander belt before die-cast horn ring is polished; otherwise, belt would load up in a few minutes



Cost per cutting edge . . .
provides an accurate measurement for comparing the costs of machining with different types of carbide tool. In this study, brazed tips were ground with diamond wheels, and solid carbide inserts were lapped

Circular fixture holds 18 carbide inserts . . .
on lap plate for automatically timed sharpening cycle, during which abrasive in liquid vehicle is pumped from sump onto plate. Three fixtures can be used simultaneously

Carbide inserts + automatic lapping = minimum tool cost

This method gets full value out of the carbide and still avoids the expense of diamond grinding wheels. Lapping machine sharpens 54 tools at a time for lower cost per cutting edge

WALTER C THUERWACHTER, tool supervisor,
G & L AND HYPRO DIVISIONS, GIDDINGS & LEWIS MACHINE TOOL CO, FOND DU LAC, WIS

Even though major savings have been effected in many metalworking plants by replacing the brazed-tip cemented carbide turning tools with throwaway bits held in clamp-type holders, there is still an element of waste in the whole throwaway method. True enough, it does eliminate the costly diamond-wheel grinding operations, and it does cut to a minimum the production lost when machines are shut down for tool changes.

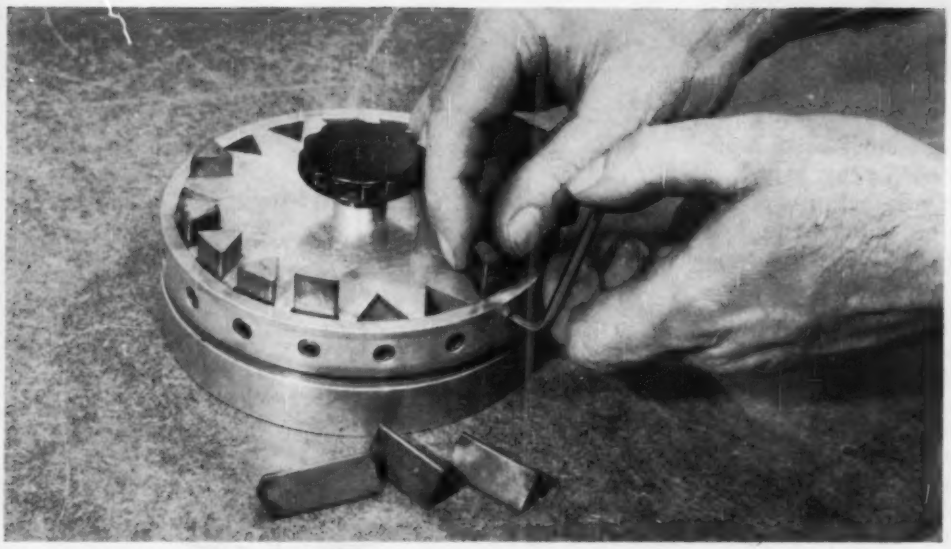
However, at the G & L plant in Fond du Lac, we have made even greater savings in our turret lathe operations by using the longer, resharpenable carbide inserts and by doing the resharpening in an automatic tool lapper. Thus, we get full value out of the carbide and still avoid the expensive diamond-wheel grinding.

Cost studies made more than a year ago showed that, for the turning and facing tools in vertical and horizontal turret lathes, the tool cost per cutting edge with each of the three types of tools averaged:

Brazed-tip tools	$0.88
Throwaway-bit tools	0.15
Clamped-insert tools	0.053.

The clamped-insert tools used to achieve the low cost per cutting edge are triangular, 1½-in.-long, ⅜-in. inscribed circle, solid carbide inserts. They are held in Vascoloy-Ramet elevator-type holders, so the inserts can be used until resharpened to a length of only ⅛ in.

The sharpening is performed on an Empire tool lapper, where three lapping fixtures, each holding 18 inserts, can be run simultaneously. The sharpening rate, measured in terms of material ground away from the ends of the inserts, ranges from 0.012 in.



Triangular carbide inserts are clamped . . .
in 5½-in.-OD, ¾-in.-thick aluminum fixture for lapping. Inserts of random lengths can be lapped, because they are loaded against gage plate (bottom) to extend equally below fixture. Different grades of carbide can be lapped at the same time, as lapping rates do not differ appreciably. Special, thin fixtures permit resharpening throwaway carbide bits by this method

per hr for new lapping compound to 0.004 in. per hr when the compound is contaminated with carbide sludge. When sharpening approximately 30 inserts a day, the compound is replaced every 30 to 40 days.

During the past year our purchases of diamond grinding wheels for resharpening carbide tools, and for grinding chipbreakers in these tools, have been reduced more than $2000 through the elimination of these operations on turret-lathe tools. This saving will be increased as clamp-type holders are applied to other machine tools in our plant.

Additional savings are made possible by reducing cutting tool inventories and storage space in tool cribs. When brazed-tip carbide tools are used, each machine operator generally will have a half-dozen or more tipped tools on his bench, and considerable tool-crib space is given over to the storage of new tools, as well as tools being resharpened. But with clamped-insert tools, the machine operator seldom need have more than one insert (6 cutting edges) at his machine, and crib space required is greatly reduced by the much smaller size of the inserts as compared with the brazed-tip tools.

TOOL COST PER CUTTING EDGE

	Brazed Tip No Chipbreaker	Throwaway Bits	Clamped Inserts
a. Size in inches	¼ x 9/16 1 in. long	⅜ triangle[1] ⅛ in. thick	⅜ triangle[1] 1½ in. long
b. Usable length of tool	⅝ in.		1⅜ in.
c. Number of cutting edges per tool	1	6	6
d. Stock removed per sharpening (av.)	0.030 in.	not sharpened	0.060 in. (both ends)
e. Resharpenings per tool	21	0	23
f. Number of tools sharpened at once	1		54
g. Cutting edges per sharpening: item c × item f	1		324
h. Total cutting edges: (item e + 1 for new tool) × item g	22	6	7776
i. Cost per sharpening cycle	$ 0.75[2]		$ 6.00[3]
j. Total cost of sharpening: item i × item e	$15.75		$138.00
k. Cost of new tools (av.): cost per tool × item f	$ 3.65	$0.90	270.00
l. Total cost during effective life: item j + item k	$19.40	$0.90	$408.00
m. Cost per cutting edge: item l ÷ item h	$ 0.88	$0.15	$ 0.053

Notes: 1. Dimension of triangular tools is diameter of inscribed circle.
2. National average estimated by carbide manufacturers.
3. Allows 1 hr to load, reverse, and unload 54 inserts. Also allows for cost of abrasive and cost of operating lapping machine.

Round Table...

Part-Time Oldsters

"What's Old Man Thompson doing around the shop, Ed? I thought he retired last year."

"He did, Al, but he got sick and tired of sitting around listening to his joints creak. I've got him on part-time work. He comes in maybe a day and a half a week. Does a good job, too."

"What's the idea? You trying to undercut the regular men? Seems to me you're keeping a younger man out of a job by giving Thompson the work."

"There's not that much work extra, Al. Thompson has a clear understanding that I'll call him in for work only if there's more work than we can conveniently handle with the regular crew. What's the matter, you down on him?"

"No, but I don't see why you have to keep him on when there are plenty of younger, more active men here. You could give one of the regulars some overtime to make up the difference."

"Maybe I could, Al, but I think it's good psychology to have Thompson working here. He's experienced and steady, and he gets his work done on time, which is more than you can say for all of your younger men. Some of them are fine, but a few could use Thompson for a good example. Besides, even if there was enough work to keep a new man busy, where would you find one as good as Thompson? Might take a long time."

"What happens when you need him and he's sick? You can't expect an elderly man to be in perfect condition all the time."

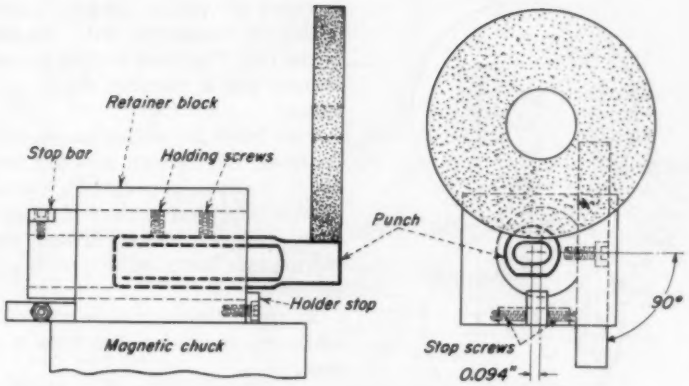
"He's not a bit less reliable than the average man in the shop, Al. Besides, if he doesn't feel good one day, there's always some of the current work that can be held off a day or two."

"I'm surprised Harrison OK'ed the deal, Ed. It must make a mess out of his records—insurance, timekeeping, and all."

"Well, I had trouble with him, but I think he's convinced now. Keeping Thompson's time straight is extra trouble, but I think it's made up—and more—by the fact that he can be called in almost any time and be expected to do a good job of work. In fact, I'm going to see if I can work the same deal with Bob Smith when he retires next month—after he gets over the novelty of having nothing to do."

• • •

***CAN INDUSTRY EFFICIENTLY** use the over-age worker who wants to work, is capable of work, and is known to be dependable? Are complications of insurance coverage, timekeeping, compensation, and other legal matters too much? Your ideas on the subject may interest others. Discussions of earlier topics starts on page 234.*



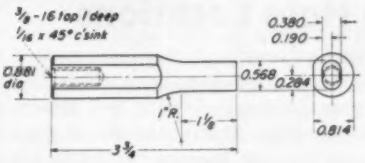
Fixture Produces Accurate Radii

The illustrated fixture was made to produce two flats and two coordinating radii on each of several hardened punches. The object was to hold the flats perfectly parallel to each other, and the radii to blend with the flats.

The retainer block was made of 3-in. square CR stock. A 2-in. hole was bored through the center for the punch holder. Holes for the front and back stops were drilled and tapped, after which the block was pack-hardened. The center hole was then honed to a good finish, and the outside ground square, maintaining the hole centered.

The OD of the punch holder was machined to a sliding fit in the block. An eccentric hole was bored through the holder, calculated to produce the radius wanted. In our case, this dimension was 0.094 in. off center. A flat was accurately milled on the back end of the holder (perpendicular to the centerline of the hole) to receive a stop bar. Three holes were drilled and tapped through the side of the holder; one to mount the stop bar, and the other two to secure the work.

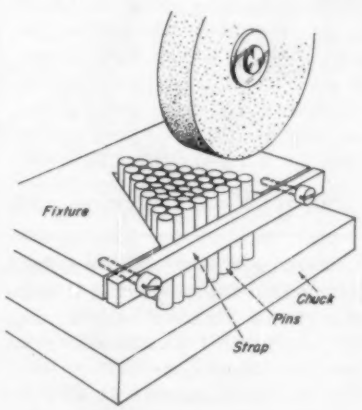
The elongated form of the punch is produced in the following manner: The two flats are ground to size first, removing an equal amount of stock on each side. This is best done by adjusting one stop screw so the stop bar is perpendicular to the grinder chuck. The holder is then revolved 180°,



and the same process repeated.

When the flats are finished, one radius can be ground at the same setting by slowly revolving the holder 180° to each stop. The workholding setscrews are then loosened and the work rotated a half turn, indicated and retightened. The second radius is then produced in the same manner as the first.

Albert H Provort, Ludlow, Mass



Fixture Holds Pins For End Grinding

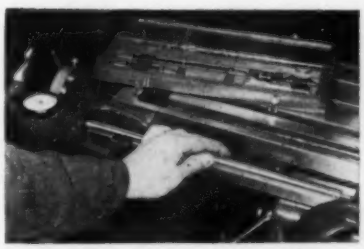
We recently produced a large number of 1/8-in.-dia pins. Their overall length had to be held within very close tolerances. This dimension was 1.1248 ± 0.0001 in.

A ½-in. plate was machined, as shown, to hold a large quantity of these pins as one unit. This enabled us to grind the pins to the prescribed limits as easily as a solid block.

The V-notch is a 60° cut, about 3-in. deep, in a 6-in. by 4-in. plate. Two halves are drilled and tapped to hold a strap across the V-notch. The depth of the cut should be adjusted to allow the last row of pins to contact the strap.

The fixture is mounted on magnetic parallels on the surface-grinder chuck. The pins are then loaded into the V-notch and retained by the strap. Thus held, the pins are ground clean on the first end. The parallels are then removed and the fixture and pins turned over. Setting the pins directly on the chuck, they are ground to the prescribed length.

S S Milardo, Middletown, Conn



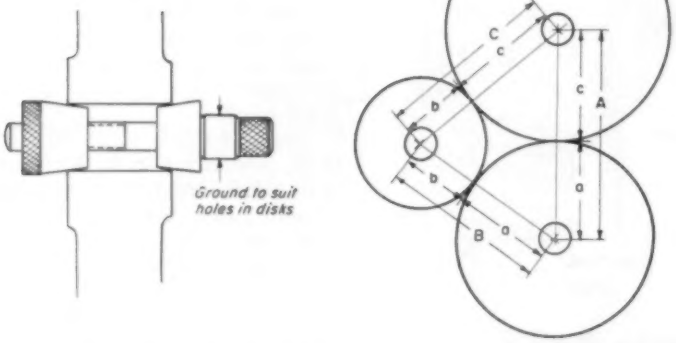
Indicator Measures Shafts

Close tolerances had never stumped us in the past, but when we had to finish several lengths of shafting to 18.375 ±0.001 in. we were really stopped. We had no micrometer or vernier that would handle this length. It wasn't until we thought of using the precision locating equipment on our vertical miller that we could finish the job within the limits.

Using master space bars and gage blocks to make up the length required, we zeroed in the indicator on the longitudinal travel to 18.375 in. From there on it was mere routine to face off the ends until they were within tolerances.

J C Magee, Schenectady, NY

Practical Ideas



Disks Verify Relative Hole Locations

The sketch shows three disks of predetermined diameters as they are used to check the locations of three holes. Tolerances on their location, in relation to each other, are plus and minus 0.005 in.

To find the exact center of each hole, stub shafts are made. Machined in two parts, they are basically bolts with tapered heads and tapered nuts. Round shanks on the heads are provided to suit the holes in the disks. The bolts and nuts are hardened, then the shanks are concentrically ground to a standard size.

When these bolts are assembled in the holes to be checked, they find their own centers regardless of variations in the hole sizes. The disks are ground to diameters based on minimum hole-center distances. The holes in the disks are a sliding fit on the ground portions of the bolt shanks.

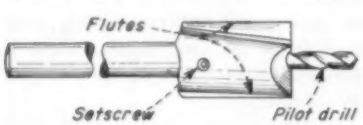
If disks on adjoining shanks cannot be assembled, the holes are too close. If they clear each other, the space is checked with a 0.010-in. feeler gage. Should the feeler gage pass through loosely, the holes are too far apart. The distances are within tolerances when the feeler gage will just enter, or when it will not enter at all.

To determine the proper diameters of the disks, A, B, and C are established as the minimum center distances. Then a, b, and c are the radii of the disk. Referring to the sketch, A equals b plus c. B equals a plus b. C equals b plus c.

Therefore, to find relative diameters:

$$a + c = A$$
$$-(c + b) = C$$
$$a - b = A\text{-}C$$
$$+ (a + b) = -B$$
$$2a = A\text{-}C + B$$
$$a = \frac{A\text{-}C + B}{2}$$

Richard Minser, Cleveland, Ohio



Drill Counterbore Combination = Round Hole

When drilling holes in sheet metal with a standard twist drill, it is always difficult to get a uniformly round hole. They will frequently come out with 3, sometimes 4, lobes jutting into the hole circle. It is for that reason we have made a number of the drill counterbore combinations illustrated.

If it should happen that we don't have the size we need, we have found it pays us to make one for the job, however small the job. To make a drill counterbore is easy. A piece of drill rod of the proper dia is selected. One end of the rod is faced off and a pilot-drill hole is drilled concentric with the OD of the rod. The piece is then turned around and a suitable shank machined.

Two flutes are milled on the cutter head, after which they are filed up to improve appearance. Clearance is then filed on the end of each flute, and a hole is drilled and tapped into the pilot hole for a setscrew.

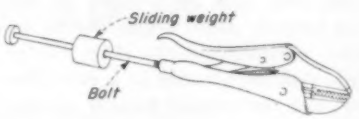
To complete the tool is now only necessary to harden and draw it as desired.

Clifford Malloy, Bronx, NY

Lubricating Sealed Bearings

Sealed ball bearings can be repacked easily and economically. This is done by immersing them in light bearing grease in a clean can and heating the grease until it thins out. In this state the grease will seep through the small openings and penetrate the bearings.

Henry Joseph, Gardenville, Penna



Lever-Jaw Wrench Serves As Puller

There are times when a light puller is a definite time saver around the shop. This one is handy for pulling stubborn cotter pins and dowel pins from blind holes.

To make such a puller, replace the regular adjusting screw on a lever jaw wrench with an 8-in.-long bolt of the same dia. The thread should be about 2 in. long to permit full adjustment of the wrench. Before inserting the bolt in the wrench, a weight is slipped on the bolt. This weight is a piece of round stock with a sliding-fit hole through its center.

To use the wrench as a puller, merely adjust the wrench to a good locking grip. The sliding weight is then rammed against the head of the bolt to pull the pin.

S. Clark, East Bradenton, Fla

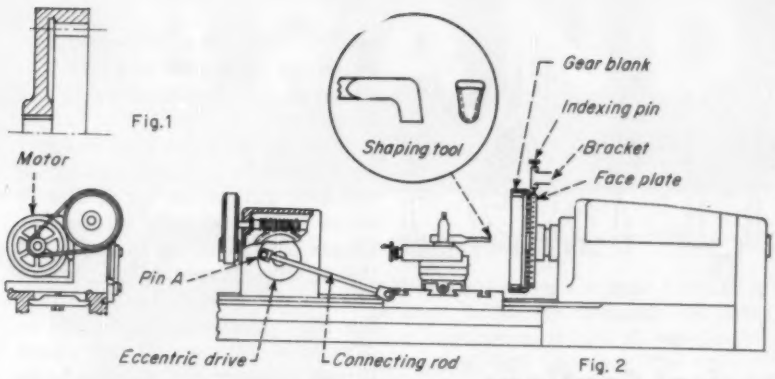


Fig. 2

Attachment Shapes Internal Gears

For the limited quantity of internal-gear parts we had to produce it was economically unsound for us to purchase a gear shaper. The regular shaper was considered, but indexing the work would require an expensive rig. A slotter would have done the trick, but since we had none, I designed an attachment to shape the gears on a lathe.

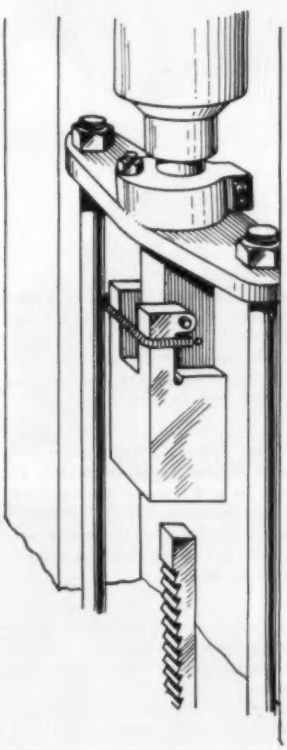
The gears are used as spindle drives for a radial drillpress. Fig. 1 shows the blank has sufficient recess to be shaped by a formed single-point cutting tool. In Fig. 2 the entire arrangement is shown with the blank secured to a face plate. Indexing is done by engaging a pin to the holes in the periphery of the faceplate. These holes are equally spaced, each representing a tooth in the gear.

An old casting was utilized to house a worm and worm-gear. It was made to fit the lathe bed, and clamped in position by the tailstock strap. As the tailstock was not used it was removed or pulled back. An electric motor was mounted on the side of the housing to supply the power to the worm.

A connecting rod links the carriage to the pin on a drive disk mounted on the worm-gear shaft. The eccentrically located crank pin provides reciprocating action to the carriage. Before this mechanism can be used, the longitudinal feedscrew must be disengaged as well as the handwheel rack; in other words, the carriage must be so free that it can be pushed by hand.

The shaping procedure is best in several sequences with a cutting-off-shaped tool as the first sequence, and the forming tool as the last. The forming-tool profile is developed by copying the contours of a suitable gear cutter.

P C Sun, Tainon, Taiwan, China



Swinging Block Reduces Ram Travel

Keyway work on small vertical broachers, where the broach is set by hand for each piece, can be speeded by a simple ram attachment. With this method there must be enough room between ram and work to allow the broach to enter the guiding horn. In our case this means that when the broach is in place, ready to cut, the ram will have to travel about 4 in. before contacting the broach.

This extra travel adds up to a lot of lost motion and waste of time in the broaching cycle. By fitting the ram with a hinged block, as shown in the sketch, the gap between the ram and the broach can be reduced. The broach can be placed in the guide by swinging the block out of the way. When the broach is properly seated, the block snaps back, leaving only a minimum of space for the ram to travel before pressure is applied.

Buckley Sullivan, Cleveland, O.

Carbide Scriber Cuts Spring Steel

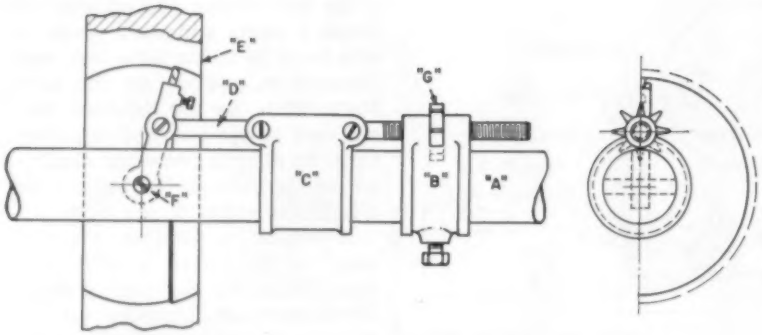
Because of the hardness of spring steel it is practically impossible to lay out work on it with a height gage equipped with an ordinary tool-steel scriber. Recently, when we were faced with making several model parts from 0.007-in.-thick spring steel, we replaced the standard scriber with a carbide-tipped tool bit ground to suit.

The result was gratifying; not only did it scribe the required layout, but we found by making several passes that it cut sufficiently deep to allow breaking the material along the line by flexing it.

Carrying the same idea a little further, we brazed carbide tips to a pair of dividers and found that we could cut inside and outside radii in the same material. Careful grinding to insure a sharp cutting edge to the tips of the dividers and the point of the height gage scriber is important.

Dean Shaw, Wantaugh, LI, NY

Practical Ideas



Boring Bar Does Spherical Seatings

Large seatings for spherical self-aligning bearings, such as are required in steam-turbine and similar work, are often avoided by the small shop because they are considered too difficult to produce. The sketch shows a boring bar designed for this purpose, which can be used in a lathe, milling machine, or boring mill.

Bar "A" is made to suit the machine in which it is to be used. Its dia should be roughly 1/3 the dia of the finished bore. A slot for the swinging toolholder "F" is milled in the bar at a location centered with the work "E". The bar is fitted with a stationary collar which carries the feedscrew and star wheel "G". A locking screw is provided to secure the collar where most convenient. The sliding member "C" acts as a crosshead between the feedscrew and link "D" which in turn is connected to the toolholder.

After the bore has been roughed out to within a few thousandths, the spherical boring bar is inserted to finish the bore. A stop or tripper is so mounted and adjusted that it will advance the star wheel one point for each revolution of the bar. Assuming the bar is in clockwise rotation, a left-hand thread is necessary on the feedscrew for an outside toward the headstock feed. Adversely, a feed away from the headstock will be the result of a right hand threaded feedscrew.

Spherical seatings of this type must be made in two halves to admit the mating element. The bar has worked well on one half at a time, or both halves clamped together.

Michael P Blake, St Louis, Mo

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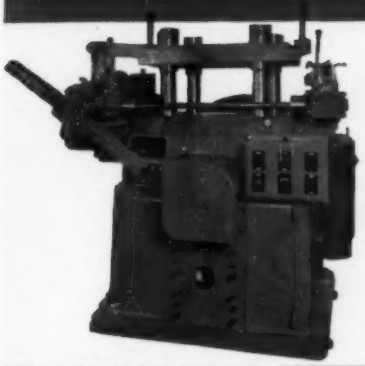

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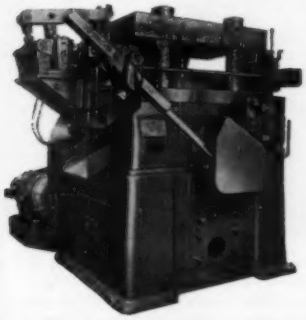

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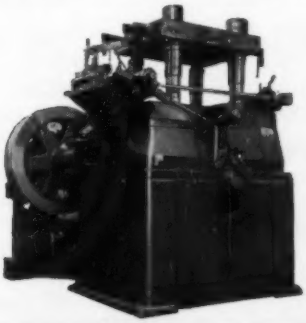

BRANDES 550 TON PRESS

Note the sturdy construction of this press which incorporates all the exclusive performance features of the smaller units described above. The quick feed eccentric is standard on this size machine as is the design arrangement of single back-gear. This press accommodates a die up to 10 ft. in length. Special width and length built on request.

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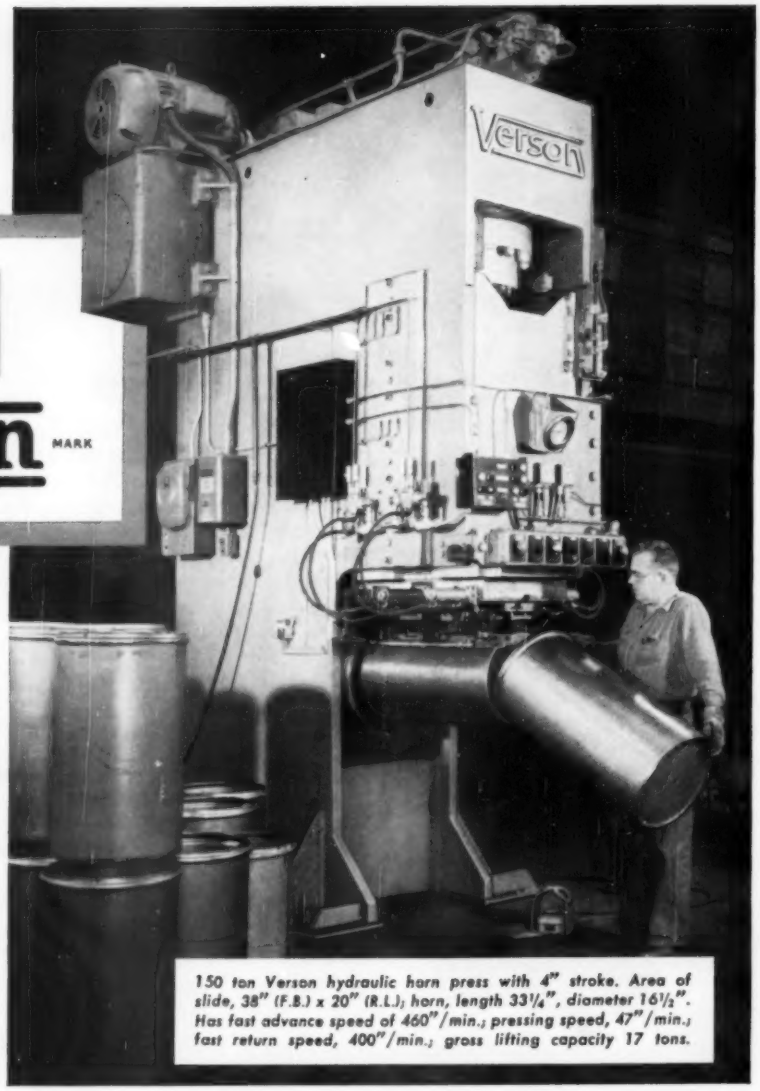

150 ton Verson hydraulic horn press with 4" stroke. Area of slide, 38" (F.B.) x 20" (R.L.); horn, length 33¼", diameter 16½". Has fast advance speed of 460"/min.; pressing speed, 47"/min.; fast return speed, 400"/min.; gross lifting capacity 17 tons.

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Tolerances and Limits . . XIII

Readers posed certain questions about interpretation of statements contained in prior installments of "Tolerances and Limits," (*AM*—Jan 28 '57, p299; Feb 11, p139; Feb 25, p171, and Mar 11, p155). This material was derived from a tentative "American Standard ASA Y14.5—American Drafting Standards Manual—Sect 5: Dimensioning and Notes," to be published by the ASME when accepted as a standard. Questions from two readers and replies by Prof Fred L Spalding, General Engineering Dept, University of Illinois, and a member of Sub-Committee 5 that drafted the tentative standard, are published herewith

PROBLEM 1

I have been following with considerable interest your articles reproducing the tentative ASA standard on dimensioning and notes. In discussing it with my colleagues, however, a raging controversy has developed. For some time we have been using the true-position method of locating holes, because we felt the round tolerance zone resulting made for easier gaging. It is only necessary to reduce the pin diameter by the tolerance to get an economical gage. The controversy concerns the location of holes by the so-called "chain method" (Fig 6a) using true position tolerances.

Two schools of thought exist:

(a) Those who believe that the location of each hole is governed by the actual location of the previous hole (tolerances accumulating)

(b) Those who believe that the dimensions locate the "True Position" and the tolerance applies after the true position is determined (tolerances not accumulating).

Fig 18 shows a series of holes located on an arc with chain dimensions and a "true position" note.

Would you please tell us which interpretation (see Figs 58 and 59) is correct?

William F Swist

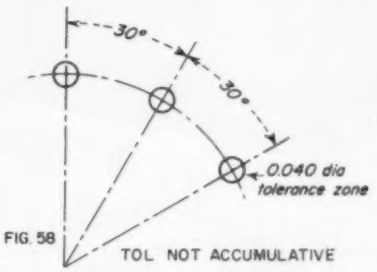

FIG. 58 TOL NOT ACCUMULATIVE

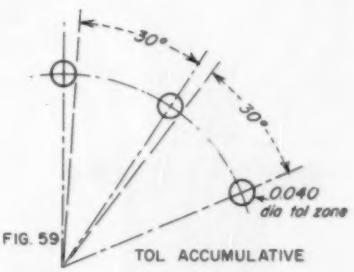

FIG. 59 TOL ACCUMULATIVE

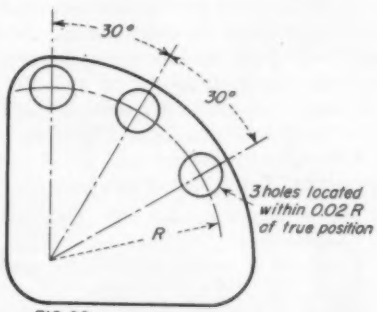

FIG. 60

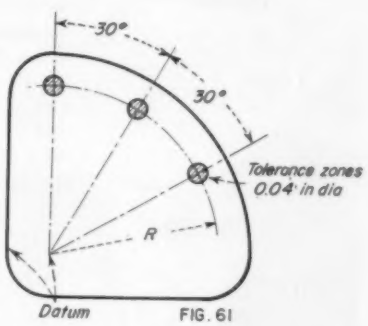

FIG. 61

ANSWER:

Of the two interpretations which you expressed in your letter, I believe it was the thinking of the committee which compiled the standard that the second interpretation is the correct one, although it is evident from your letter that the wording of the standard does not make this clear.

The true-position method is essentially a specification of a basic or theoretically exact location, arbitrarily selected and designated. Accuracy as such has no bearing on the true position. It is an exact theoretical base from which to locate features, with a tolerance to state how far actual positions may be displaced from true positions.

However, the true position is true only with reference to something else. For simple arrangements, the something else may be obvious, and need not be identified as a datum. If the datum is not specified, however, true-position expressions can often be misinterpreted, and so the question "true with respect to what" should be clearly answered in each case where a location is given as a true position.

Identification of datums, unless they are obvious, eliminates ambiguity in interpreting specifications. With rectangular coordinates, a point location is sufficiently definitive to serve as a datum; with polar coordinates, a line from which to measure angular displacements and a point from which to measure radial or diametral distances must be given to establish datum.

For the example shown in Fig 60, in the first interpretation, Fig 61, the center of the group of holes and an edge of the part have been taken as the datums, and the true position of the center of each of the holes has been located from these datums. Then tolerance zones have been established around the true positions. This, in my opinion, is the correct interpretation.

In the second interpretation, Fig 62, the first hole has been located with respect to the center of the pattern and an edge of the part, and a tolerance zone established around that true position. Then the second hole has been located using the center of the pattern and the actual location of the first hole as datums, and a tolerance zone *in relation to the edges of the part* established around that true position. This, of

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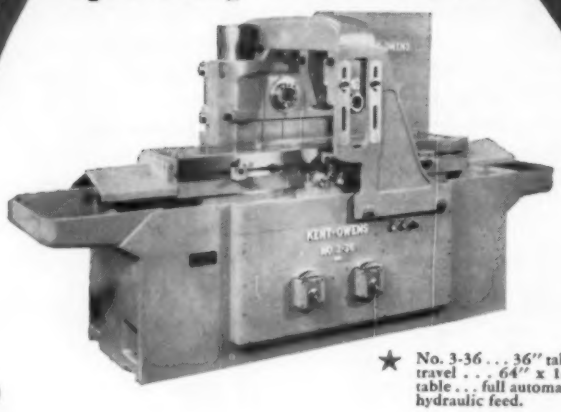

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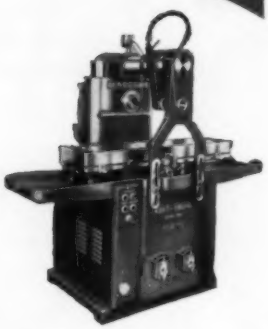

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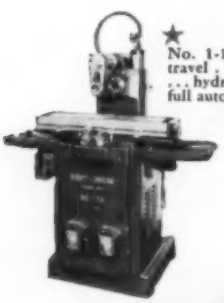

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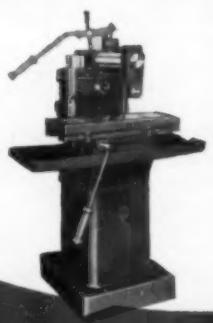

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Tolerances and Limits . . XIV

course, gives a kidney-shaped tolerance zone within which the center of the second hole must lie, its actual location within that tolerance zone depending on the actual location of the first hole in its tolerance zone. Then the third hole is located with respect to the center of the pattern and the actual location of the second hole, which gives even greater possible angular variation in the actual location of this third hole, again in relation to the edges of the part.

The trouble here is which of the holes is to be selected as a datum for which of the other holes. If the first of the three holes is selected as the first datum (for the second hole) the tolerance diagram is as shown in Fig 62. If the middle of the three holes is selected as the first datum (for the other two holes) a different tolerance diagram, Fig 63, is obtained.

The objection to both these interpretations, Figs 62 and 63, is that tolerance zones are defined in relation to the edges of the part, whereas different datums are used for the location of each of the holes.

If the tolerance zones are defined in relation to the datums, a rather different picture of the part is obtained.

If the first hole is located with respect to the center of the pattern and and an edge of the part, and a tolerance zone established around that true position, the tolerance zone is a circle, Fig 64. However, as soon as a line through the actual location of the center of the first hole is used as a datum, the tolerance zone of the first hole becomes zero in an angular direction, and becomes the amount of the tolerance in a radial direction, and the tolerance zone is a radial line, Fig 65. This puts the edge of the part, which was the original datum, into a tolerance zone as shown.

Then if the second hole is located using the center of the pattern and this line through the actual location of the center of the first hole as datums, the tolerance zone for the second hole becomes a circle, Fig 65.

When the second hole becomes a datum for the location of the third hole, its tolerance zone becomes a radial line, and the tolerance zone of the first hole reverts to a circle, increasing the tolerance zone of the edge of the part, and the tolerance zone of the third hole is a circle, Fig 66.

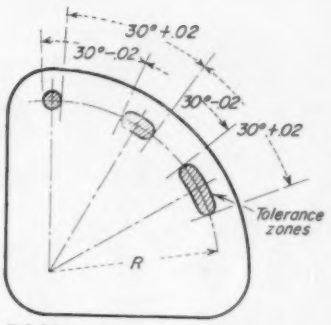


FIG. 62

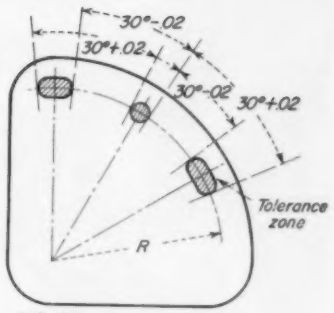


FIG. 63

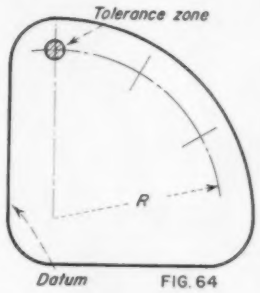


FIG. 64

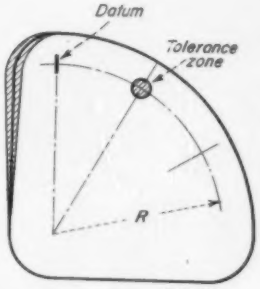


FIG. 65

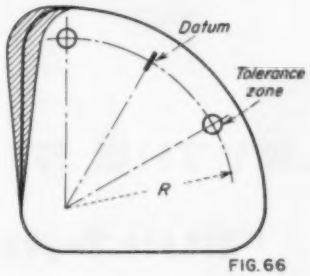


FIG. 66

However, if a datum is established, true positions are located from the datum by basic or theoretically exact dimensions. Therefore, "chain" dimensions do not accumulate tolerances. Since the dimensions do not carry tolerances, the total of the individual chain dimensions from the datum to any point is the same as the datum dimension to the same point. Then the true position tolerance gives the permissible variation within which an actual location may be displaced from its theoretically exact, or true, position.

PROBLEM 11

The attached sketch, Fig 67, shows an angle bracket with equal legs. Two different limits for squareness are possible, depending upon interpretation and method of inspection. A basic interpretation of a case like this should be included in the ASA Standard Y14.5. If the legs are not equal, how is squareness checked?

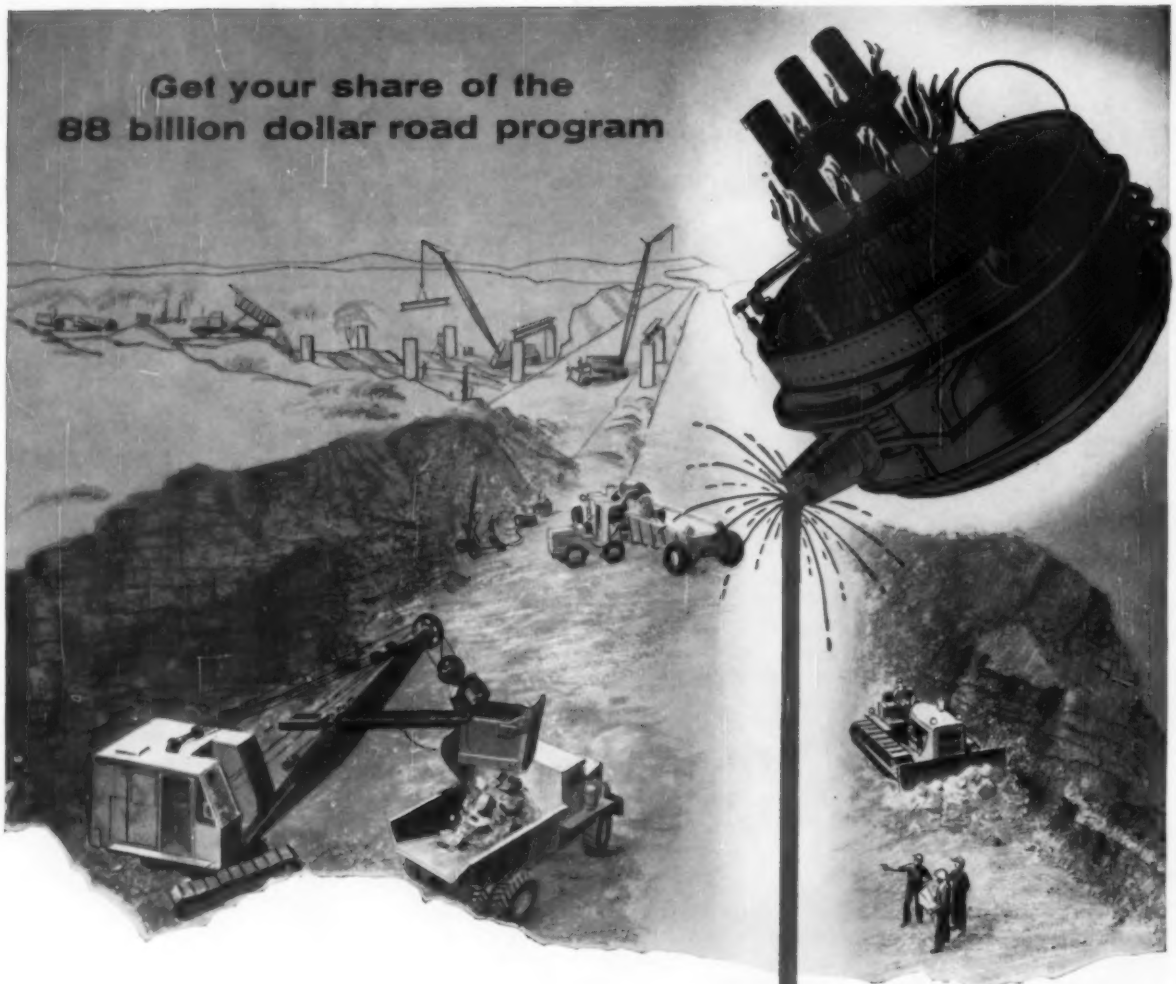
Also, are we correct in applying the interpretation that flatness and parallelism are controlled by the respective thickness tolerances on each of the legs?

We are currently working on problems of this nature and would appreciate your assistance on these interpretations.

AM Reader

ANSWER:

I agree with you that the interpretation of dimensions of this kind should be covered in the ASA standard. However, there are so many different cases that would have to be considered that it would make the standard so voluminous that it would never get read.



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Tolerances and Limits . . XV

The standard tries to take care of such cases by stating that when tolerances of form are not specified on a part drawing, it is commonly understood that an actual part "will be acceptable if it is within the dimensional limits given, regardless of form variations," which, in cases of this kind, might be interpreted differently by different people.

The usual interpretation of such a drawing is that the outline of the actual part must lie entirely within the tolerance envelope established by the limit dimensions. The outer boundary of such an envelope is easily determined. It is the outline at maximum material, in other words, the outline of the perfect form established by the maximum dimensions. The inner boundary is the perfect form defined by the minimum limits.

This drawing does not show any datum surfaces, that is, it does not show any starting point for the dimensions, so the difficulty lies in determining the proper location of the inner boundary of the envelope in relation to the outer boundary. If a datum surface had been specified, this surface of the two boundaries could be made to coincide, and the relationship between the two boundaries would be established.

Interpretation (*a*) is in effect making the lower edge and the right-hand end of the horizontal leg the datum surfaces. However, any variation in the perfect squareness of the right-hand end of the leg would have to be taken off the width of the 0.010 wide tolerance zone. Interpretation (*b*) makes the right-hand end of the horizontal leg and the upper end of the vertical leg the datum surfaces, and again, any variation in the perfect squareness between the ends of the legs would have to be taken off the widths of the 0.008 and 0.010 wide tolerance zones. Interpretations (*a*) and (*b*) both, of course, include the restriction that the limits of thickness of the legs must not be exceeded, which means that the permissible variation of the inside surfaces depends upon the actual variation of the outside surfaces.

There is nothing on the drawing to indicate that the squareness of the outside surfaces is more important than the squareness of the inside surfaces, so that my interpretation would be that the 0.008 and 0.010 tolerances merely indicate the length of the legs, and the squareness is established by the 0.002 and 0.004 tolerances.

Therefore, in my opinion, the 0.002 and 0.004 tolerances on the widths of the legs establishes that the edges of the legs must lie within tolerance zones of widths 0.002 and 0.004, as shown in interpretation (*c*), which includes the condition that if the entire tolerance zone is used on one side of the legs, the other side of the legs must be perfect. However, any variation in one side of the legs may be accompanied by a corresponding variation in the other side, provided that in no case does the width of the legs exceed the limits of the dimensions. This throws the variation which may be permitted by the 0.008 and 0.010 tolerances into the ends of the legs.

If one surface were specified as a datum, and the notation "square with datum within XXX" added to the drawing, or included in general specifications for implied tolerances referenced on the drawing, then the interpretation as shown in (*a*) with a tolerance zone of the specified width, would be correct.

If the tolerances on the width of the legs were made greater than 0.010, then, of course, the given 0.008 and 0.010 tolerances would establish the zones of permissible variation, and the interpretation (*b*) would be correct.

If the legs were of unequal length, the interpretation (*c*) would still apply, the length of the legs being extended and the same variation in tolerance on the length applying at the outer ends of the legs. This would have the effect of leaving the width of the tolerance zone the same as it is with equal legs, but changing the size of the permissible variation in the squareness when measured as an angle.

Also, it is my opinion, that the thickness tolerances on each of the legs definitely control the flatness and parallelism of the two sides of the legs. This means that the errors of flatness of each side of the legs must be contained within a tolerance zone, such that the total of the two tolerance zones on the two sides of each leg must not be greater than the total tolerance allowed on the thickness of that leg. Similarly, the surface of either side of each leg must be parallel to the other side of the leg within a tolerance zone equal to the total tolerance allowed on the thickness of that leg.

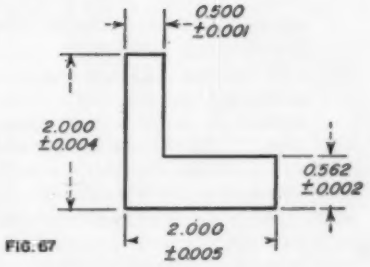
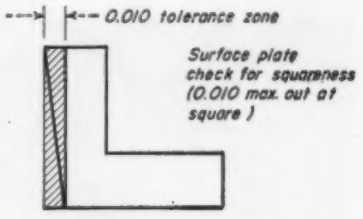
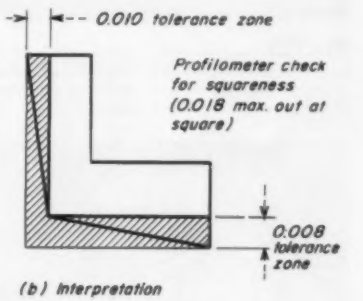


FIG. 67

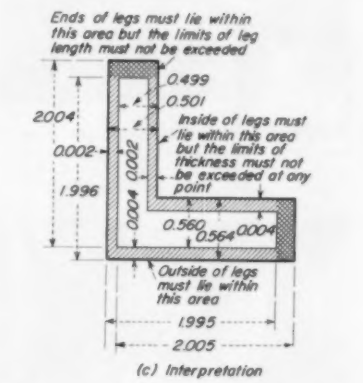
This on the drawing



(*a*) Interpretation



(*b*) Interpretation



(*c*) Interpretation

Fred L Spalding

STAINLESS DIRECTORY

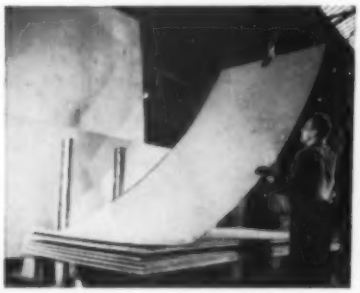
Buyers Guide to Ryerson Stainless Stocks & Services

Here's a quick guide to the nation's largest stocks of stainless steel—2,351 sizes, shapes, types and finishes of Allegheny stainless in stock at Ryerson.

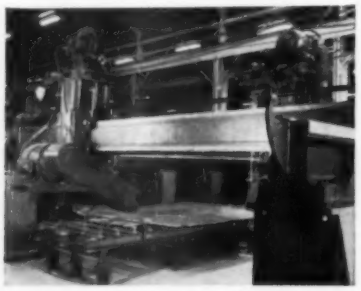
This wide selection assures you of getting the best stainless for every application. Extra care in storage, handling and shipping—such as padded shear clamps to protect finish and flatness of sheets—guards the high quality of Ryerson stainless stocks. And in addition, the help of full-time stainless specialists is yours when you call Ryerson.

See your Ryerson catalog for a complete listing of stocks and call your nearby Ryerson plant for quick shipment of Allegheny stainless—one piece or a truckload.

SHEETS—11 analyses of Allegheny stainless sheets in stock including nickel and straight chrome types. Also extra wide sheets to reduce welding costs.



PLATES—Available in 9 analyses including plates to Atomic Energy Commission requirements and to ASTM specifications for code work. Also extra low carbon types for trouble-free welding.



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A NEW STEEL—Type 202 Allegheny Stainless is available in 14 to 26 gauge sheets. Type 202 compares favorably with 302 in corrosion resistance; costs 2¼¢ per lb. less.

BARS AND ANGLES—Rounds, squares, flats, hex's and angles in 8 types including free-machining bars with both analysis and mechanical properties controlled for best performance.

CIRCLES, RINGS, SPECIAL SHAPES
—Practically any shape, no matter how intricate, can be accurately flame cut from stainless steel plate by skilled Ryerson operators.

PIPE AND TUBING—Light wall, standard and extra heavy pipe, ornamental and regular stainless tubing. Also flanged, screwed, welding and Quikuple fittings and Cooper stainless valves.

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Talking Shop...

Inspector Training

A FOUR-DAY course for supervisory inspection personnel is offered by the DoAll Technical Institute. The course is free to people sponsored by their own companies and includes 20 hours of shop training in the calibration of gage blocks.

Off Season

WE are a bit late (or perhaps quite early) in reporting some advice gleaned from the tiny publication put out by Miniature Precision Bearings: "The exchange of Christmas presents ought to be reciprocal rather than retaliatory."

Cermet Progress

METAL and oxide mixtures containing a portion of coarse particles has been found to have higher as-formed densities and lower sintering shrinkage than mixtures made entirely of fine powders. However, the strength of mixtures with coarse powders was lower. Vibratory compaction apparently was equivalent to hydrostatic pressing in respect to as-formed densities and vibratory compaction was most promising for small, intricate shapes. These are among the conclusions of a research project at North Carolina State College for the Wright Air Development Center. In the meantime, at Ohio State, researchers are investigating the use of a ceramic-fiber base for cermets.

Gold Discarded

THERE HAS BEEN a change in the procedure for the finish on the earth satellites manufactured for Project Vanguard by Brooks & Perkins. In the article (*AM*—Jan 14 '57, p101) that broke into the public view the details of manufacture of these satellites, we said that the finished shell would be gold plated for visibility and ease of tracking.

The gold plate has been discarded in favor of vaporized aluminum. The finished shell will be given a coating of clear silicon monoxide, then a microscopically thin coating of vaporized aluminum, and finally another coating of silicon monoxide. Main reason for the change from gold to aluminum is to increase heat reflectivity of the satellite. It is expected to operate in temperatures ranging from – 200 F to perhaps as much as 600 F as it makes its 90-minute trips around the earth.

In drawing the magnesium shell, incidentally, Brooks & Perkins is lubricating the blanks with colloidal graphite in a naphtha suspension ('dag' 41). The same lubricant is also used both on the inside of the blank and on the spin block for the secondary spinning operation. We should have mentioned the form of lubricant when we described the process originally, but when it comes to hot drawing of magnesium, we have a tendency to take colloidal graphite for granted.

Titanium Cladding

A PROCESS to clad steel with titanium has recently been patented in Britain by Lukens Steel. One side of the titanium is plated with iron or nickel (other side of the sheet is coated with lacquer). After the stop-off lacquer has been removed, the plated side is placed in contact with the steel plate in a gas-tight graphite-coated steel cover. The case is filled with inert gas and heated to 1000 to 1500 F. After heating the pack is reduced 20% by rolling, pressing, or forging. Sandwich is getting more expensive all the time!

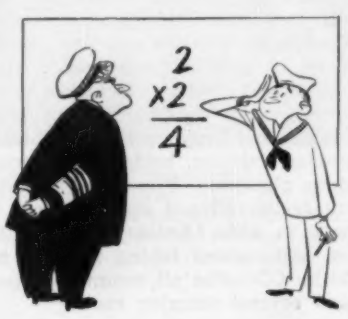
Now It Can Be Told

ONE of the problems in building the atomic power plant for the *USS Nautilus* was with stainless steel forgings several feet in diameter and several inches thick. Carbon-steel nuts and bolts were found imbedded in several of the forgings and were discovered during the machining. Evidently they were not melted in making the original ingot and were not detected during the forging operation. To obtain four of these tube sheets for the heat exchanger, eight forgings had to be produced.

This story is told by Admiral Rickover in a bulletin of the AEC called "The Industrial Atom." This experience seems fairly typical, for to get the 50 large forgings required for the Navy's nuclear program to date, about 100 had to be made. The 50 that were scrapped cost many millions of dollars. In the same way, 375 large stainless castings were produced to get 250 acceptable ones.

Don't Underestimate

A SAD case cited by Admiral Rickover in his report on the Navy's nuclear program concerns the tendency of firms to underestimate the magnitude of a job. An example is of an instrument company given a contract to develop and produce control-drive mechanisms. The original cost estimate (made in competition with others) was $970,000 and delivery was set for Jan 31, 1955. The final mechanisms were delivered in April 1956 at a cost of $3.5 million. But the point that roused the Admiral's well-known ire appears to be that it wasn't until a month before the original delivery date that the company began to appreciate the magnitude of the job that it was attempting.



Long-Term Upward Trend Forecast

WASHINGTON—The machine tool industry will do a substantial business right through 1957. The outlook for 1958 is good. The long-term trend in machine tool sales will be upward. Research and development are advancing at such a pace that obsolescence is going to compel continuing replacement programs in large volume.

These favorable opinions were voiced by Jerome A Raterman, president Monarch Machine Tool Co, at the 55th spring meeting of the National Machine Tool Builders' Association at the Sheraton-Park Hotel May 2-3. He was speaking as president of the association.

Government relations was the keynote of the meeting, with many prominent government officials as speakers. A panel discussion of lower costs through coordination between engineering and manufacturing was a popular feature, with M A Hollengreen, president of Landis Tool Co, as moderator.

Mr Raterman stressed that expansion projects are progressing today at a reasonable rate. Some of those cancelled were long-term affairs, and others on second thought appeared too pretentious. Extreme price competition, he contended, spurs manufacturers into getting rid of old high-cost equipment and installing more economical equipment. This will go on as long as volume holds up; and today all indications are that the volume of goods and services produced will continue at a high rate.

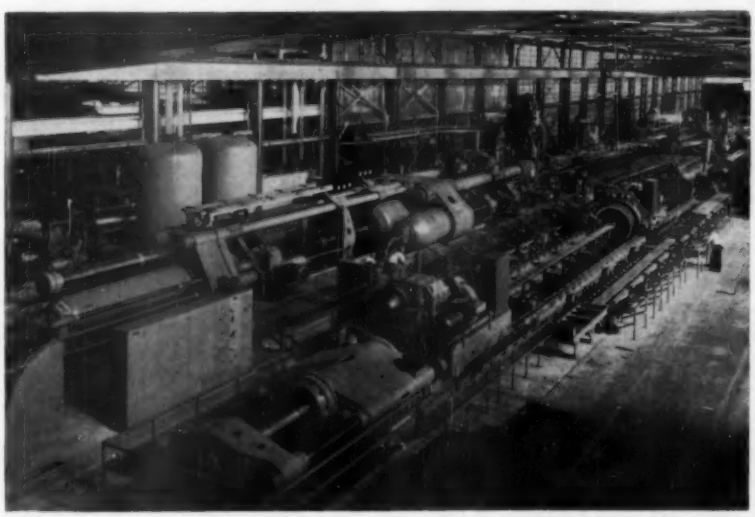
U S government is the largest owner of machine tools and now is one of the industry's largest customers, Mr Raterman pointed out. Government relations thus are customer relations. More than that, every phase of the machine tool industry's business is affected by the laws, actions and policies of the U S government. It is the responsibility of the industry to keep Washington officials informed about machine tools and about the industry so that they can make more intelligent decisions. There are "areas of cooperation" in which the machine tool industry and government agencies can work to their mutual advantage.

European-built machine tools are threatening to come into the U S market in higher volume than before, Mr Raterman said. Nevertheless, chief concern is "about the correction of difficulties which have cut our exports to a mere fraction of their former volume." Mr Raterman stressed the importance of working with government people to develop factual statistics, based on terminology and classifications generally accepted and understood throughout the machine tool industry.

The Air Force and Navy Bureau of Air in particular have made progress toward machine tool modernization, Swan E Bergstrom, chairman NMTBA government relations committee and executive vice president

Dow Chemical Unveils World's Largest

MADISON, ILL—Once destined to produce magnesium parts for Germany's Luftwaffe, the world's largest magnesium extrusion press (it's also the second largest for nonferrous metals) is slated to do a similar job for the U S Armed Forces. The 13,200-ton press, "liberated" at WWII's end by U S forces, was built by Hydraulik GMBH of Duisberg, Germany, for I G Farben. One of several large presses, it was only 65% complete, when leased by Dow Chemical Co from the Air Force. Press's first production order will be 18-in. structural sections for Army Engineers' portable landing mats. Later, it may extrude round, hollow tubing for missile bodies, airframes and flooring for aircraft, chassis and body parts for military ground vehicles, bridges and aerial drop platforms. Press can extrude integrally-stiffened sections from 9 to 20 in. wide, I-beams from 11 to 28 in. high, round tubing from 10 to 24-in. OD—plus all common shapes and several complex ones.



Press and stretcher . . .
Dow's 13,200-ton magnesium extrusion press (left background) is 250 ft long, including runout. Automatic 1000-ton-capacity stretcher (foreground) will straighten extrusions as long as 80 ft, with 40-sq-in. cross-sectional area. Other auxiliary equipment includes billet heaters, a 320,000-lb-capacity aging oven, three die-heating ovens, a contour-correction machine; a tube and round straightener, a 400-ton hydraulic straightening press; three pickling tanks

in Machine Tool Demand

Cincinnati Milling Machine Co, reported. Replacement of old and obsolete equipment is to be a main factor in their facilities program. They will be guided by a formalized replacement manual to be issued shortly by the Defense Department (see page 111).

No real progress has been made in procurement policies of government agencies, Mr Bergstrom said. A lot of work has yet to be done to put the buying of machine tools on a more objective basis. There are too many variances and interpretations of procurement regulations today.

A number of reports indicate that foreign machine tools are being offered to the armed services and in some cases have been purchased, Mr Bergstrom commented. These machines are being quoted and meet specifications set up for the armed services' replacement programs. Best way to handle this problem is to work with procurement people in getting proper specifications and analyses of jobs to be done. Mr Bergstrom said that his committee is preparing a statement for the Treasury Department on the revision of Bulletin F.

Completion of the M-Day machine tool trigger program (pool orders) has been delayed because of the six-months' limitation clause in the government contract, Wallace E Carroll, director Metalworking Equipment Division, Business and Defense Services Administration, Department of Commerce, stated. This clause leaves out of the program the medium and slightly larger sizes of machine tools. It specifies a delivery date within six months of M-Day. BDSA hopes to convince ODM that this clause should be changed to a longer delivery.

Meanwhile machine tools that take more than six months to build are to be eliminated from the 91 contracts covering, prior to this deletion, some 15,500 tools valued at $334 million. In this way it is hoped, Mr Carroll brought out, that the eight unsigned contracts will be completed and the first phase of the program ended by June 30.

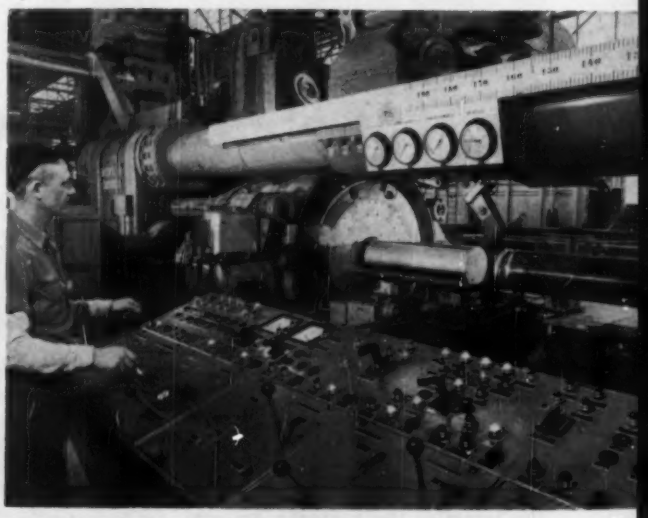
BDSA's Metalworking Equipment Division is planning to reactivate shortly the Long Lead-Time Machine Tool Task Committee, Mr Carroll said. It is believed that the committee can develop data showing the need for an immediate program for building a minimum inventory of elephant tools while full mobilization requirements for the nuclear-war concept are being determined. BDSA has received from the Defense Department, he declared, the latest list of metalworking machinery for mobilization purposes. This list enables BDSA to find out to what extent the machine tool industry's capacity to produce measures up to M-Day needs.

Though the suggestion has been made that in a nuclear war main reliance should be on military end

(Continued on next page)

(13,200 tons) Magnesium Extrusion Press

Some 2½ times bigger than any magnesium press... . . . the Dow magnesium press achieves a maximum hydraulic pressure of 130,000 psi, maintains constant efficiency at each pressure stage (3000, 5500, 7700, 9700 and 13,200 tons). Maximum ingot length 71 in.: maximum extrusion length 80 ft



Operating console controls ram movement . . . Press speed is 16 full-stroke extrusion cycles per hr of 71-in.-long ingots, including piercer operation. With 65-in. ingots, press performs 19 cycles per hr. Shorter ingots increase the number of cycles per hour correspondingly

MACHINE TOOLS (continued)

items in being, many mobilization advisors believe that the winner of the next war may be that country which, after the opening attack, gets to its feet and readily puts its production back into operation, Mr Carroll emphasized.

Bulletin F Review

In deciding to review the useful life tables for depreciable property in Bulletin F, contained in the 1942 edition, Internal Revenue has recognized the urgent desirability of bringing recommended schedules up-to-date, Russell C Harrington, commissioner of Internal Revenue, said. The advisory group making the review has had three meetings since its organization in March.

Mr Harrington invited NMTBA and its member companies to submit suggestions for revision to him by June 30. "We shall welcome your experiences regarding normal useful lives, including, where practicable, average useful lives of composite and group accounts. Operating conditions, technological improvements and economic changes will be considered important factors in determining normal useful life expectancies." Mr Harrington also invited submission of design, engineering and operating data about particular machines involving special or unique situations.

In its study of useful lives of equipment, Internal Revenue hopes to make a limited number of field surveys, especially in the larger, representative plants in which various types of newly-developed equipment can be seen in a single inspection. Up to now, Mr Harrington said, the response by industry to the invitation to submit facts and figures and suggestions has been less than hoped for. He pointed out that administratively Internal Revenue has shifted emphasis from the past to the future in determining useful lives of depreciable property.

New Leasing Policy

A new leasing policy for government-owned production equipment has been recommended to the Office of Defense Mobilization by an interagency task group, Gordon Gray, ODM director, revealed. The purpose is to insure uniform and equitable treatment of all users of government machines. He urged adoption of the recommendations as a package rather than piecemeal.

Mr Gray declared that recommendations would 1) apply to leasing for both defense and non-defense production; 2) be adhered to uniformly by all federal agencies; 3) establish uniform provisions in all leases for such matters as the term of the lease, purchase and renewal options, restrictions on extent and character of use, maintenance, installation charges, inbound and outbound transportation and removal costs, disposition arrangements, and rental rates; 4) set graduated rates based on acquisition cost of the equipment (actual rates have not yet been agreed upon and therefore were not mentioned by Mr Gray); 5) make all users pay rent in form of regular payments rather than by means of an end-product price-offset; 6) ask for Congressional legislation authorizing payment of lease rentals into a pool to be made available to lessor agencies for "programmed expenditure on equipment modernization, replacement, rebuilding and repair."

"Consensus Principle"

Present defense mobilization program has made progress, Mr Gray contended, because of the working of the "consensus principle." Whenever any group is affected by government planning, it should participate in the planning process, and no group should be permitted to dominate decisions at the expense of others.

Defense Department has approved retention of 273 reserve machine tool packages, Perkins McGuire, assistant secretary of defense in charge of supply and logistics, reported. Approval of 199 other packages is pending. Tools may be withdrawn from packages only tobreak a production

Defense Overtime Pay Cuts Will

WASHINGTON — The Pentagon, alarmed because its major procurement programs are costing much more than budget estimates, wants to cut down on overtime pay handed out by Defense Dept contractors.

Biggest overtime problems occur in the aircraft and missile industries, but because the big development push today is on ballistic missiles, the Pentagon is willing to overlook overtime payments in that field. That leaves the aircraft industry as the target of the Pentagon drive to cut costs.

A high-level Pentagon official blames excessive overtime on lack of competition. "Once you get past design and into production, there is none. You only have one manufacturer of each plane, and there's no inhibition about scheduling of work. Overtime in these conditions becomes routine."

Air Force Directive

In line with Pentagon directives, the Air Force has issued these instructions:

- Plant representatives of the military can authorize overtime up to 2% of a project's total man hours, but only if it's justified.
- Any overtime above 2% must be given prior approval by either the Air Materiel Command, or the Air Research & Development Command.
- Overtime will be sanctioned for one other reason—if it is necessary for maintenance of a production schedule—and only in rare cases approved by the Pentagon.

Navy's Bureau of Aeronautics has issued instructions similar to the Air Force's. The Army, which has no comparable overtime problems, has merely advised its procurement setup against overtime that is not absolutely necessary.

The timing of the crackdown—less than 60 days before the end of fiscal 1957—leads to speculation that it is a transitory measure that could be relaxed when the new fiscal year arrives. But reliable sources in the Pentagon high command insist "it's something the Services are going to have to live with for an indefinite period."

Out on the aircraft-dominated

bottleneck on a high-priority defense item, and then only on a loan or replacement basis.

For three years the Defense Department has had the help of NMTBA members, distributors, surplus machinery dealers and machine tool users in making on-site inspections of machine tools stored in mobilization reserves, Mr McGuire stated. It will take five years, he said, to complete this inspection job. Excess equipment for disposal has been reviewed to decide whether the items could be used by another department or should be kept in reserve. Testing equipment to find out its condition is one of the jobs being done.

Defense Department is not interested in leases simply for revenue purposes, Mr McGuire brought out. The purpose of leasing is to keep equipment in place and ready for military production if and when needed. All leases are made under terms preventing unfair competition. In all, 28 leases have been approved. Ten of them require replacement of the government-owned machines within one to three years. Others were approved because of special circumstances.

There is an ever-increasing demand for greater reliability, more precision, and closer and closer tolerances in producing new military weapons, Mr McGuire said.

Move To End Fast Writeoffs

WASHINGTON—Washington is in another scrimmage over one of its favorite political footballs—fast tax writeoffs. Senate hearings on a bill by Senator Harry Byrd of Virginia, longtime foe of this method of encouraging production expansion, kicked off the latest round in an old debate that has split the Eisenhower administration.

The Byrd bill would in effect do two things: (1) limit fast tax writeoffs to those companies who are producing or doing research and development work directly for the military or for the Atomic Energy commission; and (2) virtually restrict Certificates of Necessity for the writeoffs to those companies with direct defense contracts.

The split over fast writeoffs came when Treasury Secretary Humphrey, himself an old opponent of rapid tax amortization, backed the Byrd Bill. Then along came new Defense Mobilizer Gordon Gray, who says the Byrd Bill is "unnecessary."

But President Eisenhower blew sky high the hopes of those who had been holding out for more—not less—of this special tax aid. At a recent press conference, he came out flatly for ending by law the government's authority to give five-year amortization to any plants except a few directly connected with producing items important to national security. In effect, this gives a big boost to Senator Byrd's attempt to get a fast-amortization "repealer" through quickly, although the President didn't mention specific legislation.

Defense Mobilizer Gray's opposition view to the Byrd Bill is shared by most industrialists—certificates granting five-year writeoffs in place of the usual 20-year ones help spur new investment. ODM is already limiting fast writeoffs to only those items needed for rock-bottom defense mobilization—although this has sometimes been interpreted by ODM to apply to indirect military procurement, too.

Contract-in-Hand Problems

The Humphrey-Byrd (and evidently Eisenhower) view is that tax writeoffs should be granted for plants or facilities already built. But restriction of writeoffs to firms having a defense contract already in hand presents a tough problem. Some Washingtonians think this ruling is unworkable because so many firms in practice start building plants and acquiring equipment on the unspoken promise of getting military contracts.

Hit West Coast Aircraft Firms Hardest

West Coast, the Pentagon cutback order made banner headlines. There it was estimated that overtime restrictions could result in as much as a 10% cut in a $40-million weekly aircraft payroll. And there was a great deal of confusion as to how restriction of overtime to 2% of wage payments could be applied wholesale without wrecking delivery schedules. Subcontractors, many of them already feeling a pinch, were especially concerned—figuring substantial overtime cuts with the primes would mean layoffs for the subs sooner or later.

Despite all the hoo-haw in West Coast newspapers, the aircraft producers themselves see the cutbacks as more of a headache than a disaster—"if the government gives us an order, we'll comply."

North American Aviation, for example, estimates that it has been doing 5-7% overtime overall, and figures a cut to 2% won't mean much.

Bookkeeping Headache

Biggest headache over the cutbacks will come in the bookkeeping departments, which have to figure out what needs cutting and what doesn't. Clarification from Washington is needed, too, because with some contracts overtime can't be pared without delivery stretchouts. One aircraft maker, pending clarification, put a general stop on all overtime, except for missile work.

Reaction generally out on the Coast is that the order is politicking over the much-maligned budget. And most resentment stems from the suddenness of the order, which gave the aircraft people no time to plan for it.

And there's some feeling that the overtime paring won't save money necessarily, particularly in cases where it would cost more to add to the straight-time workforce to meet a delivery schedule than to pay a trained workforce overtime—because of the learning curve. The new ruling is expected to have more effect on subs than primes because the subs have been using overtime as a regular thing—even to the point of placing "help wanted" ads with overtime as an attraction.

At Ford's new Sterling, Mich, chassis parts plant

Automatic Assembly Teams Up With

STERLING, MICH—The newest developments in welding techniques, and in automatic assembly have been combined with the best possible safety and working conditions at Ford Motor Co's new 1.8-million-sq-ft chassis parts plant here.

Lastest welding techniques—CO_2 gas-shielded arc welding—are employed to fabricate rear axle housing and other parts (see photos on opposite page).

Automatic assembly has been carefully thought out at Sterling. Four 40-ft-long Gilman machines (see photo lower left), each weighing 35 tons, automatically assemble parts to form ball-joint front suspension units. In one such machine (for assembly of the upper suspension arm), basic parts are locked in a fixture for movement along a circular track through 38 stations.

Electrical controls and cam mechanisms direct the assembly of 13 component parts—and they inspect the completion of each operation. The machine rivets, loads bushings, retainers, lockwashers and screws; applies torque to screws; assembles cover, shield and seal; fills the ball joint with grease; and applies a protective paper tube. Nine stations in each machine are equipped with automatic inspection devices.

If any defect is indicated in automatic checking, a memory unit designates the part as a reject and it moves through the remaining stations without further work being performed. Operators load and unload the machine which cycles 640 times every hour.

Two smaller rotary index machines automatically assemble the upper and lower ball-socket assembly. Equipped with memory units that check the quality of the assemblies, these machines cycle 1280 times an hour.

Transfer machines process such items as front wheel spindles, axle housings, differentials, bearing caps, carrier cases, drive shaft spiders.

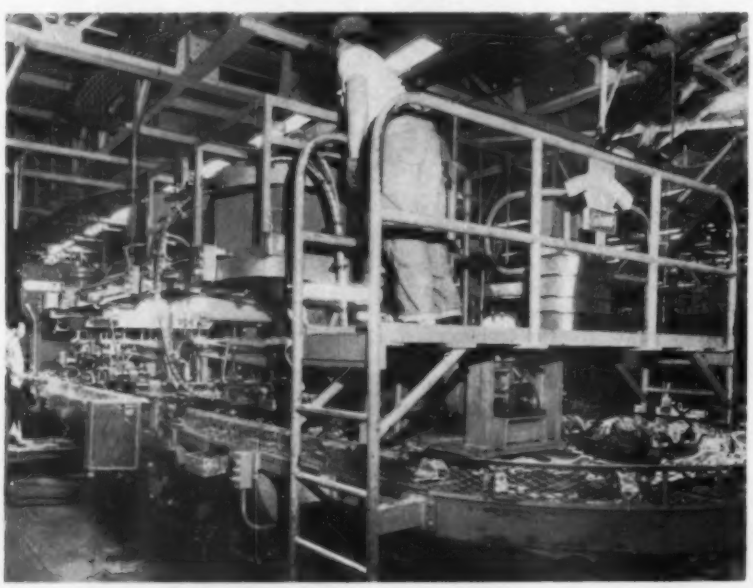
Machining of axle housings, for example, starts at a line of Impco horizontal qualifying machines, where the housings are manually loaded into automatic transfer devices. Work is first transferred to a station that checks rough machining stock. From here it is moved to a flange facing station where the housing is machined to length. Five stations are built into each Impco machine. One for loading and qualifying, a second for facing the flange ends to length, and the remaining three are idle for possible additional operations in the future.

Transfer from this setup to a Footeburt machine is automatic and here four holes are drilled in the flanges at both ends of a housing. These holes are checked automatically by probes after which they are chamfered on the back faces of the flanges. The bearing and oil seal bores are then rough bored and the housing is automatically ejected into rails that carry them to a Snyder Trunnion-type transfer machine.

Here they are manually loaded in a vertical position for rough and finish facing the banjo surface—two separate stations—followed by drilling and chamfering ten holes in these faces at two more stations. Automatic unloading follows to put the housings on transfer bars for delivery to a special Ex-Cell-O horizontal transfer machine for finish boring the bearing and oil seal bores. They are manually unloaded from this machine and placed on a floor conveyor where all burrs are removed by hand. Final operation is to wash the housings after which they are conveyed to final assembly.

Five transfer machines process front wheel spindles. Each machine contains 18 stations and weighs 127 tons, and each requires 3,000-square-feet of floor space. The 84 tools in each of these machines remove about 200-lb of metal an hour.

Located near the steel receiving area, several Verson transfer presses shape coiled steel into parts for rear axle housings and front suspension arms, making use of progressive dies which perform several operations on parts moving through ten or more stations. Mechanical fingers index the parts through successive stations and each cycle of the press moves one blank into the series of dies and one completed part out of the opposite end. The Sterling plant also has a gear cutting department consisting of 695 Gleason automatic machines to rough and finish cut pinion and ring gears.



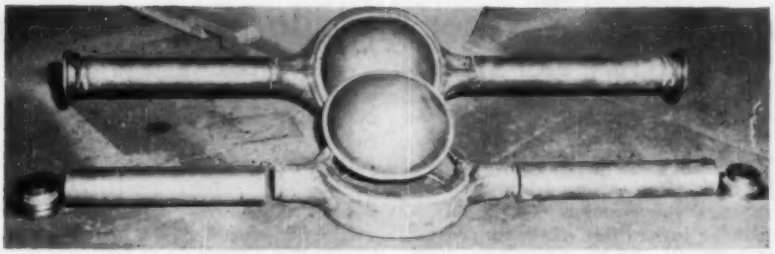
Automatic assembly of ball-joint front suspension units . . . at Ford's new Sterling, Mich, plant is handled in this Gilman Index-O-Matic, which carries 640 assemblies per hour through 38 stations. One of four at Sterling, machine is equipped with nine automatic inspection stations

CO_2 Welding

- *No flux is needed*
- *Welding is faster*
- *Joints are stronger*

. . . since Ford changed over from submerged-melt arc welding to a CO_2 gas-shielded technique at its Sterling plant, where it is employed in high-volume output of rear axle components. Special Agnew and Expert welders are equipped with Westinghouse West-ing-arc welding controls and wire drives, including a crater elimination circuit and a voltage compensating device that maintain constant secondary voltage, regardless of fluctuations in the primary.

Side delivery of CO_2 from a special nozzle reduces downtime for nozzle cleaning to a minimum. The designers believe this equipment is a "first-in-the-industry" because the welding head, control and power source are designed to JIC standards. Pictures and captions on this page describe the step-by-step CO_2 welding process.



1 . . . new welding technique
for rear axle housings cuts floor-to-floor time by 32%, provides deeper penetration of the weld and reduces cost of materials. Three operations are performed as the work progresses from one machine to another. First operation joins the cover to the banjo-shaped housing; second welds the tubes to the housing ends: third puts flanges on ends of the tubes

2 . . . arc time is cut
from 35 to 16 seconds in welding covers to banjo housings. Welding speed with West-ing-arc process, employing CO_2 as a shield, is 140 ipm—compared with 70 ipm previously. Fixture in this Agnew machine is tilted at 25° for proper flow of weld metal, and optimum welding speed. Work is rotated under the welding head while clamped in position by upper ram

3 . . . two end tubes are joined at once
after being pressed into place as housings are automatically positioned. Entire unit is rotated while automatic heads with CO_2 gas shield make the joints. Completed parts are automatically ejected onto conveyor. Floor-to-floor time: 28 sec

4 . . . assemblies are manually loaded
and flanges positioned on the ends of tubes in final operation. Two opposed rams press flanges into place. Then assembly automatically indexes into position under welding heads. As work rotates during welding, operator sets up next assembly. Entire floor-to-floor time is 28 seconds

Papermaking Techniques for Metals

Is Fiber Metallurgy the Successor to Honeycomb?

CHICAGO—Fiber metal, a continuous sheet material prepared by felting in much the same manner as paper is made, will reach the low-cost production stage soon. Already, a wide range of products, self-supporting yet as much as 95% porous, can be turned out with this process, it was reported by Armour Research Foundation's Cord H Sump and William Pollock at the 13th Annual Meeting of the Metal Powder Association here April 30.

This means that fiber metal could take the place of honeycomb, itself a relatively new material, in many applications. Fiber metal has one decided advantage over honeycomb—its density can be controlled from almost-solid metal to 95% porosity today, and within the near future it is expected that porosity can be increased beyond that point.

Metal Wools Best Material

At the moment, commercial sources of metals for fibering are limited to metal wools and wire—with metal wools getting the nod because of their comparatively low cost.

First step in making fiber metal is the cutting of metal wool to specified lengths—important because the length determines the structure of the fiber. Carbon and stainless steel wools, for instance, can now be cut to average lengths of 1/16 or ⅛ in. on automatic hammer mills and shearing equipment. Cut fibers are then felted, using either glycerine as the suspending liquid, or organic materials dissolved into water. Air felting is a possibility now being examined. The resulting metal felt can readily be handled despite its 96-97% porosity.

The metal felt, which is formed on a cloth backing, must be sintered (at temperatures roughly approximating those used in normal powder metallurgy processes) to form metallic bonds or welds where the fibers are in contact. This, of course, establishes fiber rigidity. It has been found that while the felt and its cloth backing can both go into the sintering furnace, where the cloth burns off, it is preferable first to remove the cloth and to wash the felt. This insures a cleaner furnace atmosphere.

Today, felting and sintering facilities can produce sintered stainless metal fiber sheets 12 in. wide by 20 in. long, several inches thick. Cold-rolling of sintered stainless sheet is currently under investigation, too.

Alpha Molecular Crystals

Alpha molecular metal crystals—so small a billion of them take up less space than a grain of salt—came in for their share of discussion, too, at the Metal Powder meeting. Compressed, these crystals cling to each other tenaciously to produce unheard-of tensile strengths. Some examples:

- Alpha molecular iron combined with nylon has produced a leaf spring insert for Ford cars that withstands "shake, rattle and roll" tests, as well as temperature extremes from –20 to 130 F. Some inserts have gone through 300,000 testing cycles without appreciable wear.
- A bearing part made from an iron-copper mixture of sub-micron particles was compared by Vickers Inc with case-hardened steel. The steel lost 1% of its weight, failed after 564,000 revolutions. The alpha molecular bearing was still running, without loss of weight, without observable wear or heating when the test was abandoned after 722,870 turns.
- A molecular iron-nylon bearing produced at the Robbins Co, a plastics manufacturer, "withstood loaded pressures far in excess of those which could be imposed on standard bushing material."
- Alpha molecular iron, combined with similar copper crystals produced in Navy-sponsored research by Dr Michael W Freeman, produces welding tips of superior electrical conductivity.

Iron Powder Output Up

During the meeting, MPA officials reported that the iron powder industry shipped an all-time high of 32,500 tons in 1956. That compares with 2000 tons shipped in 1946.

During 1956 about 14,000 tons of iron powder went into manufacture of such structural parts as cams, gears and other machined parts; some 145 tons into metallic friction materials, brake linings, clutch facings, etc; and 1000-or-so tons into electronic and magnetic applications. Other applications: coated electrodes for welding, flame cutting, scarfing.

Powdered Metal Parts Job Shops Form New Association

PITTSBURGH—Some 21 of the "smallest and largest concerns" in the powdered metals industry have banded together to form the Powder Metal Parts Manufacturers Association at meetings held here in April.

The new Association's membership is confined solely to firms concerned with custom fabrication of powdered metal parts. It excludes from its membership captive shops and supplier organizations.

Among the giants of the powdered metal field included in PMPMA's roster of charter members are: Chrysler's Amplex Division, Yale & Towne's Powdered Metal Products Division, Joseph Dixon Crucible Co's Dixon Sintalloy Inc, Bound Brook Oil-Less Bearing Co, Ferro Corp's Ferro Powdered Metals, United States Graphite Co, American Powdered Metals Inc, Chicago Powdered Metal Products Co, and International Powder Metallurgy Co.

Purpose of the Association, according to its newly elected president, K M Gleszer, executive VP of Dixon Sintalloy, is to "promote the use and sale of powdered metal bearings and parts. To develop improved technical standards, and further to disseminate design information to aid engineers throughout the industry." The Association also plans to maintain a statistical survey service for members.

Other officers elected at a board meeting April 29 in Pittsburgh were William Toepletz, president, Bound Brook Oil-Less Bearing Co, vice president; and G L Bachner, general manager, Powdered Metal Products Division, Yale & Towne Mfg Co, secretary-treasurer. Site of a national headquarters and selection of a permanent Association staff will be announced later, PMPA president Gleszer says.

Tomorrow's Materials Handling:

Fewer Flashy Gadgets, More Basic Mechanisms?

"Let's get down from that Cloud No. 9 and do some basics on *mechanical* handling"

PHILADELPHIA — "Standardize, combine, simplify"—these are the three commandments that the materials handling industry has laid down for meeting the challenge of automated production. And that means fewer flashy electronic gadgets, more attention to basic mechanical handling, engineers and production men attending the Seventh National Materials Handling Exposition at Convention Hall here were told during a five-day show and concurrent technical meetings April 29-May 3.

Some 6000 pieces of equipment of 100 basic types, ranging from simple plastic tote boxes and steel storage racks to giant cranes and complex conveyor systems, were on display at the Show, which was sponsored by the American Materials Handling Society and produced by New York's Clapp & Poliak, Inc.

Some 250 exhibitors displayed upwards of $5-million worth of equipment—focusing attention on the fact that more than one-fourth of all factory payrolls is expended to pick up materials, move them, and set them down again.

The Show's theme, "Materials Handling—Key to Automation," was underscored by a conference on industry problems, in which executives from more than 20 firms and organizations discussed the impact of automation upon their work. The speakers all stressed the need for simplifying, combining and standardizing handling methods if they are to keep pace with recent developments in machining and automatic assembly.

Most speeches were keyed to the future—effect of automated plants on materials handling; how plant layout must be changed for optimum usage of tomorrow's equipment; why greater emphasis must be placed on materials handling in the years ahead. "To the extent that automated lines exist, there is no need and no place for a conventional materials handling man," reported James Bright of Harvard. "Random intermittent movement and storage of materials throughout the plant will be minimized more and more by continuous-flow systems."

Putting the whole idea into a nutshell, Westinghouse's J Wellington Hall said that industry must "get down from that fleecy Cloud No. 9, stop dreaming about electronic brains and controls, and do some basics on good mechanical handling."

Tomorrow's plant, taking gravity into account, will probably be two-story rather than single story—so that distances traveled can be shortened, according to Chicago's Irving M Footlik: "In many cases it has been found that the handling cost of getting from one end of the building to another uses up all the gains that were derived from the one-story level."

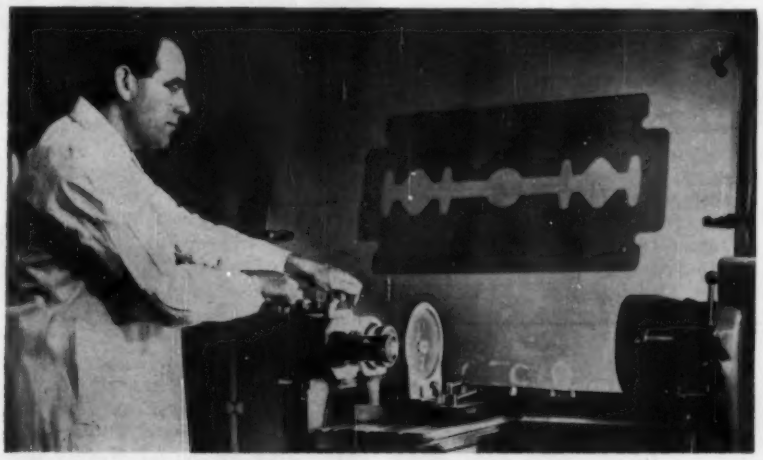
His contention, and that of several other speakers, is that future plant layout must have materials handling design incorporated into it at the blueprint stage—not after the plant is built.

Most-talked-about exhibits at the Show bore out re-emphasis on mechanical control. For instance:

- An elaborate "Trans-Free" conveyor system, shown by Detroit's Allied Conveyors, is completely mechanical in its transfer operation, can be provided with any number of intermediate work stops without halting or slowing the speed of the main conveyor system.
- A vacuum-turnover unit made by Vac-U-Lift Inc, Salem, Ill, utilizes twin vacuum pads to lift and turn over heavy metal sheets.
- A device which is essentially a tire placed around delicate objects—inflated, it grips the object gently, lifts it safely. The maker: Presray Corp, Pawling, N. Y.

While the trend was largely back to mechanical principles, one electronic control exhibit was notable: Barrett-Cravens Co's "Guide-O-Matic" operator-less tractors—electronically controlled units that follow guide wires over the plant floor. One model can pull up to 10,000 lb at a top speed of 6 mph.

Perhaps the best indication of the standardization toward which the materials handling industry is steadily moving was the increasing display of compartmented units, assembly bins, parts containers, storage racks, and conveyor segments—all accenting simplicity and flexibility in materials handling.



Biggest horizontal projector?

Claimed by its British manufacturer, Optical Measuring Tools, to be the world's largest, this horizontal projector can magnify small pieces of precision work to 100 times their size. Razor blade is shown magnified 20 times. Other lenses can be added to unit for greater magnification

FIELD REPORT

East...

800 See H-W-B's "Machine Tool Show"

MOUNT VERNON, N Y—More than 50 machine tools were shown in operation to 800 representatives of metalworking companies at a four-day show held by Harrington-Wilson-Brown Corp to observe its 33rd anniversary April 30-May 3 as a machine tool distributor in the New York-New Jersey-Connecticut area. All 14 of the firm's factory-trained sales engineers were in attendance. John H Daum, who was executive vice president and general manager of the Cincinnati Planer Co before becoming Harrington-Wilson-Brown's president, reported unfilled orders on April 1 were 20% above 1956 and shipments were up 300%. (See photo at right).

Auto showroom techniques for machine tools . . .

More than 50 machine tools operating under power were the big attraction for some 800 representatives of metalworking firms as Harrington-Wilson-Brown Corp observed its 33rd anniversary with a four-day "machine tool show" in Mount Vernon, N Y. The distributing firm reports its first quarter shipments ran about 300% ahead of comparable 1956

Eastern periscope . . .

Crucible Steel is launching a $1.5-million expansion program for **Vacuum Metals Corp,** an operating division of the company's Sanderson-Halcomb Works at Syracuse, NY. Slated to double capacity for production of high purity vacuum-melted materials, plans include a new vacuum induction furnace able to turn out 3000-lb ingots . . . **Daystrom, Inc,** Murray Hill, NJ, maker of electrical, electronic, and nuclear instrumentation, is completing negotiations for purchase of **Transicoil Corp.** Products of the Worcester, Penna, firm, including special purpose motors and servos, are expected to supplement **Daystrom's** activity in the guided missile and aircraft fields . . . **Linde Air Products Co** has changed its name to **Linde Co, Division of Union Carbide Corp** . . . **Kollsman Instrument Corp,** Elmhurst, NY, has an AF contract (in excess of $1 million) for pilot production of a navigational set, known as the Kollsman Astro Tracker . . . **Pratt & Whitney Co** is moving its Rochester, NY, branch office facilities to enlarged quarters in the Linden Industrial Park area of the city. New grinding and tool sharpening service will be set up at the site . . . **US Industries, Inc,** has acquired **Kett Corp,** Cincinnati research and development firm engaged in aircraft, missiles, and atomic energy fields. Kett technicians will staff USI's R&D Technical Center going up at Pompano Beach, Fla . . . **Kaiser Metal Products** has a half-million dollar contract from **McDonnell Aircraft** for production of engine shrouds for the F-101B jet fighter. Production, scheduled to stretch well into next year, will be carried out by the Fleetwings Div of the Bristol, Penna, firm.

West...

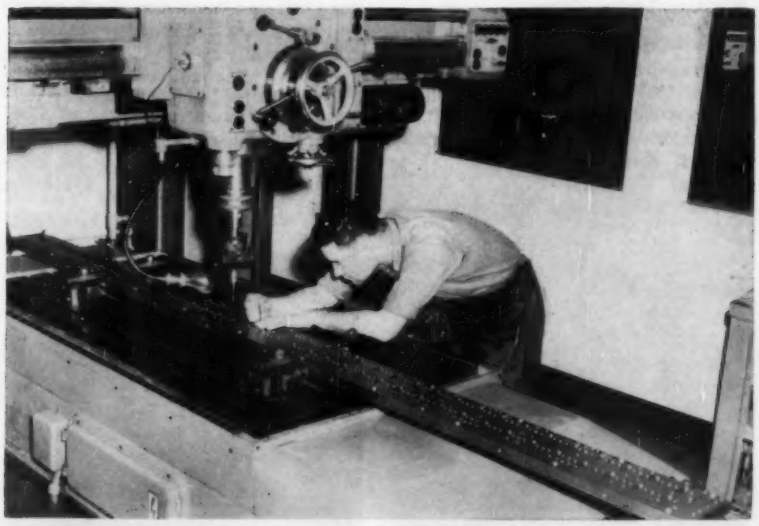
In the West . . .

Navy's $4-million order for **Ryan Aeronautical's** KDA Firebee jet target drones ups the San Diego firm's contracts for this equipment to $19.5 million. Expanded production schedules extend well into next year . . . **Aerojet-General Corp,** Azusa, Calif, has a $3.5-million contract from Navy Bureau of Ordnance to build jet assist take-off units and spare igniters. **General Tire & Rubber Co,** subsidiary, designer and developer of the type of JATO unit ordered, will produce them at **A-G's** solid rocket plant in Sacramento . . . **North American Aviation,** Downey, Calif, has been given an additional $21 million for research and development work on the AF Navaho missile, currently undergoing tests in Florida . . . **Siegler Corp's Hallamore Electronics Division,** Anaheim, Calif, reports a boost of more than $1 million in an original order from **Convair Division** of **General Dynamics** for missile test equipment; contract now totals over $4 million . . . **Burg Tool Mfg Co** is displaying a new tape control machine at its Gardena, Calif, factory. It'll be marketed through direct representation and firm expects to begin delivery this month . . . **Weldaloy Products Co** of Detroit has opened a western division in Burbank, Calif, to supply copper alloy products, parts, and materials for resistance welding . . . **North American Aviation** has an option to purchase some 12,600 acres of land in Washoe County, Nev . . . **Convair's** $40-million Astronautics missile plant is 30% complete. Engineering and administrative staffs will move in this summer, remainder of personnel by next spring. Facility will include eight buildings on a 252-acre site . . . California production of metal containers is on a $257-million-a-year level, according to study made by American Can Co. Production increase matches national expansion in can output of 60% since 1947. . . . Expansion plans are in the works to increase production volume of the **Schroeder Manufacturing Co** to $5 million annually. The Long Beach firm, maker of valves and accessories for the aircraft industry, was purchased by Frederick W Richmond of New York last month. Company will move into a 25,000-sq-ft facility, now under construction, by Sept 1; it'll employ 200 persons when operating at full capacity.

Midwest...

Midwest newsbriefs . . .

Victor Adding Machine Co, Chicago, has taken over the automatic screw machine plant of a former supplier, **Lander Manufacturing Co.** Facilities and operation, including skilled workers, will enable **Victor** to produce its own parts for calculators, adders, and cash registers . . . Salaried and hourly employees at **Ford's** River Rouge plant toted up earnings of $308,893,920 for first three months of this year, only slightly under peak figure recorded for last quarter of 1956. Hourly pay-check for first quarter of '57 averaged $108.53 per week as against $82.21 national average weekly earnings for all manufacturing industries . . . **Little Giant Products, Inc,** Peoria, has been licensed to make and sell complete line of non-hydraulic forklift truck attachments developed by the **Kughler Companies** of New York . . . **White Sewing Machine Corp** of Cleveland has contracted to purchase all outstanding stock of **Boyer-Campbell Co,** Detroit distributor of line of mill supplies and safety equipment. **B-C** name and operating management will stay as is . . . **Lincoln Electric Co** is adding another 10 acres to its 20-acre-floor-area plant in Cleveland. The $8.5-million addition will enlarge capacity of the electrode and machine divisions, swell storage space . . . Sale of assets of **Pressed Metals of America,** Port Huron, Mich, to a group headed by John D Leighton, former president of the company, (*AM*—Mar 25 '57, p185) fell through at the ninth hour. **PM** is rehauling, plans to resume production of automotive suspension parts in half of the main plant after auction of surplus equipment May 14-16 . . . First quarter net earnings for two of the Big Three made life worth living for their stockholders: Chrysler's $46.5 million as against $10.9 million for same period in '56 meant $5.34 per share this year instead of last year's $1.25. Ford showed $100.5 million ($1.85) as compared with $73.7 million ($1.37). General Motors was slightly off, reporting $261 million ($0.93) against last year's $283 million ($1.01) . . . **Bowmar Instrument Corp** is putting up a 30,000-sq-ft factory and office building in Fort Wayne, Ind . . . **Weatherhead Co,** Cleveland, has bought the assets of **Plew Tool Co,** Columbia City, Ind, producer of cutting and forming tools. Plans are in the works to double facilities.



"Metal Swiss cheese" . . .

is Standard Pressed Steel Co's term for this operation, in which an 11-ft-long dieholder for an automated production line is machined on a precision optical jig borer, which is making more than 800 holes in the 3-in.-thick dieholder. The holder will hold 188 piercing dies in making adjustable shelving. A mating toolholder contains the piercing tools that will punch the 188 holes into pressed steel shelving uprights. Tool and dieholder set will be the first station in a 4-stage automatic transfer die. Giant jig borer shown here can spot holes in dies to within 1/25,000 in. in a 6-ft length

South...

Around the South . . .

Milton Roy Co of Philadelphia has started to put up an 18,000-sq-ft plant in St Petersburg, Fla. Slated for early summer completion, it'll replace the present pilot operation in Gulfport, currently making parts for the company's controlled volume pumps . . . **General Electronics Corp** has started business in Montgomery, Ala; it's producing electronic components for the aviation industry . . . **Woodman Packaging Machinery Co** has opened its $1-million plant at Lithonia, Ga. New outfit makes high-speed weighing and packaging machinery, mainly for the food industry . . . Navy will put up a $40 to $45-million jet aircraft training station at Brewton, Ala . . . Two radar air traffic control centers, another Navy project, will be built during the year starting July 1; one will be at Beaufort, SC, the other at Jacksonville, Fla . . . **Thermo Products,** North Judson, Ind, producer of heating and air conditioning units and other metal fabrications, will build a 14,000-sq-ft branch plant at Denton, NC. Initial construction will start late next month . . . **Industrial Manufacturing Corp** has started operations in Tuscaloosa. New firm makes filter tanks, hot water heaters, and river buoys . . . **F J Stokes Co** of Philadelphia has opened a new sales office in Atlanta . . . Machinery manufacturer **Proctor & Schwartz** is beginning operations in a 76,000-sq-ft plant at Waynesville, NC . . . Defense Dept has requested an additional $19.5 million for continuance of work on converting Greenville, SC, Air Force base to a strategic Air Command installation . . . **Stanley Building Supplies Co,** subsidiary of **Stanley Works,** has opened its southeastern division headquarters in a 12,000-sq-ft warehouse-office building in Atlanta . . . **Trane Co** of La Crosse, Wis, will build its $2-million southern plant in Clarksville, Tenn. Production of central residential air conditioners is scheduled for next year . . . Looks as if rumors that **Gulf Oil** will build a $120-million refinery at Charleston, SC, have some foundation; **South Carolina Electric & Gas Co** has confirmed that it will build an electric power plant there with potential capacity of 100,000 kw.

L B Szal (left), production manager of the Super Tool Division of Van Norman Industries, has been appointed vice president, production. **Milton J Steffes**, general manager, sales and engineering, has been named vice president of these operations

E C Wilson, associated with Illinois Gear & Machine Co since 1942, has been elected vice president

Names in the News . . .

Paul L Lantz has been appointed production manager of the Abrasive Division of Norton Co. Mr Lantz, who succeeds the late **George A Fyrberg**, moves up from the post of assistant manager of the industrial engineering department.

Arthur S Nippes has been named vice president and general manager of the Henry Disston Division of H K Porter Co. Mr Nippes was formerly associated with the Elliott Co, maker of power plant equipment.

Howard W Merrill, director of operations at Martin Co's Baltimore Division, has been named a vice president of the company and general manager at Baltimore. He succeeds **William B Bergen** who retains his post as executive vice president.

H Follett Hodgkins, Jr, assistant to the vice president and general manager of Rollway Bearing Co, Syracuse, NY, has been appointed assistant general manager of the company.

Harry St John has been named manager of sales for Sundstrand-Denver Division of Sundstrand Machine Tool Co, Rockford, Ill. He was previously associated with United Aircraft, Hamilton Standard Division, Windsor Locks, Conn.

Dr George A Roberts, vice president of Vanadium-Alloys Steel Co, Latrobe, Penna, has been elected president and board chairman of the Metal Powder Association. **Christopher L Snyder,** vice president of General Ceramics Corp, Keasbey, NJ, has been named first vice president; and **Carl G Johnson,** vice president of Presmet Corp, Worcester, Mass, second vice president.

Roy Mackenzie has been promoted from assistant to manufacturing manager of Lockheed Aircraft's Georgia Division. He succeeds **Ralph Osborn,** named executive vice president of Lockheed Aircraft Services Inc. **William B Rieke** takes over Mr Mackenzie's former post, and **William A Benson** succeeds Mr Rieke as assistant production manager.

C J Baumgart, president of Screw Machine Engineering, Chicago, has been elected vice president of the National Screw Machine Products Association.

O H McCleary, vice president and general manager of Mathews Conveyor Co, Ellwood City, Penna, has been elected president of the company to succeed **L T Sylvester,** named board chairman.

Dana B Jefferson, Jr, a partner of Walker Manufacturing Co, Medfield, Mass, has been elected president of the National Screw Machine Products Association

Walther H Feldmann, executive vice president of Worthington Corp, has been elected president to succeed **Edwin J Schwanhausser,** named vice chairman of the board

James K Wingard has been appointed manager of engineering of the Press Division of E W Bliss Co. He was formerly chief engineer of the Rolling Mill Division

Roberf M Zimmerman has been promoted from assistant to general manager of Lipe-Rollway Corp. He will be in charge of the company's heavy-duty clutch and machine tool divisions

H J Louth has been named works manager of Ohio Crankshaft Co's Crankshaft and Camshaft Division

George N Levesque, director of research in the Machine Tool Division of Brown & Sharpe Mfg Co, has been appointed to head research for the entire company

Hayward A Gay has been appointed manager of the Machine Tool Division of the Cincinnati Milling Machine Co and **Philip O Geier, Jr,** has been named manager of the Products Division. **Swan E Bergstrom,** executive vice president, has recently been acting manager of the Machine Tool Division in addition to his other duties. Mr Gay, a vice president of the company, has been manager of the Products Division since it was founded in 1944 to make and sell Cincool, a cutting fluid. He is a graduate of Ohio State University and the Harvard Graduate School of Business Administration and has been with the Cincinnati Milling Machine Co since 1932. Mr Geier has been assistant manager of the Products Division for about a year and has held other posts in that division since 1950, when it added the manufacture and sale of grinding wheels. He is a graduate of Williams College and the Harvard Graduate School of Business Administration. He has been with the Mill since 1939.

Ernest M Riggleman has been elected vice president and manager of the Chicago Division of American Bosch Arma Corp. He has been managing the division since July.

W W Lusk, sales engineer for United Engineering & Foundry Co, Pittsburgh, has been appointed manager of machinery sales.

James A Arney has joined Aro Equipment Corp, Bryan, Ohio, manufacturer of air tools, as division manager for southern Indiana and western Kentucky with headquarters in Indianapolis.

Paul R Welch, formerly plant manager of William R Whittaker, Ltd, Lynwood, Calif, has been appointed works manager of McCulloch Motors Corp, Los Angeles builder of chain saws, motors, and engine products.

Drummond R Stuart has been named general manager of Black & Decker Manufacturing Co, Ltd, Brockville, Ontario, subsidiary of Black & Decker, Towson, Md.

Eric C Butt has been named works manager of the four Los Angeles plants of Topp Manufacturing Co, a Division of Topp Industries, Inc, Beverly Hills, Calif.

Henry S Harrison has been appointed plant superintendent for the machine and tools division of Michigan Tool Co, Detroit. He will supervise manufacturing operations of the company's Six Mile Road plant. **Al Combs** succeeds Mr Harrison as superintendent of the Gear-O-Mation Division.

Thomas R Rudel, president of Rudel Machinery Co, New York, has been elected a director of Gould & Eberhardt, Inc, Irvington, NJ, manufacturer of machine tools. Mr Rudel is chairman of the board of Rudel Machinery Co, Ltd, of Canada, a director of the American SIP Corp, former president of the American Machine Tool Distributors' Association, a member of its executive committee, and chairman of its public relations committee.

Hayward A Gay

Philip O Geier, Jr

OBITUARIES

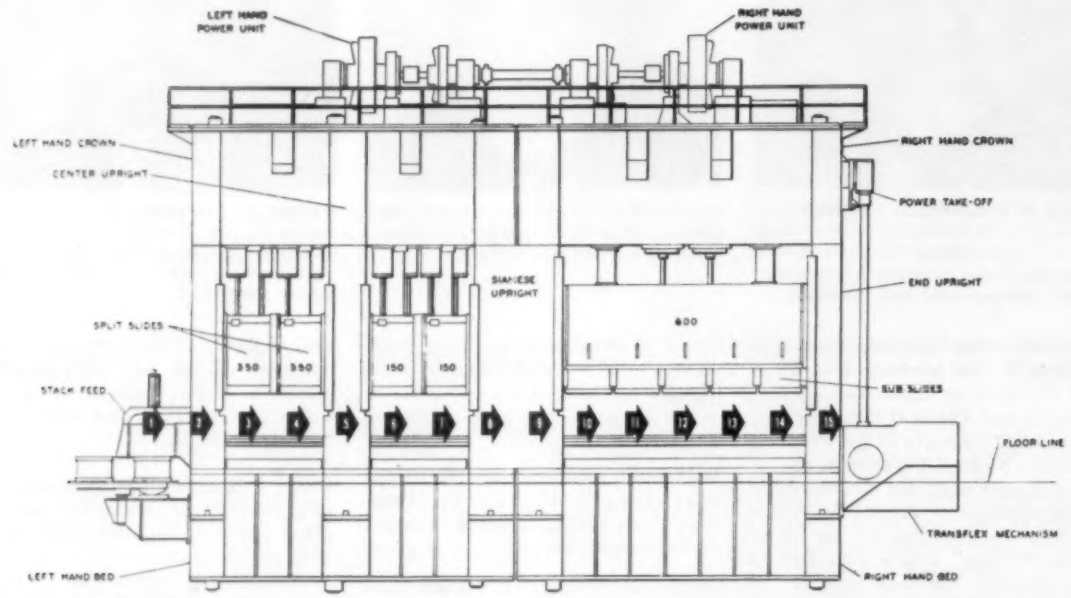
Harry A Severson, 79, board chairman of Barber-Colman Co, Rockford, Ill, died April 18 in Rockford.

John Jay Hopkins, 63, board chairman of General Dynamics Corp, died in Washington, DC, May 3.

Dexter S Kimball, Jr, 50, vice president of Bendix-Westinghouse Automotive Air Brake Co, Elyria, Ohio, died April 28 in Cleveland.

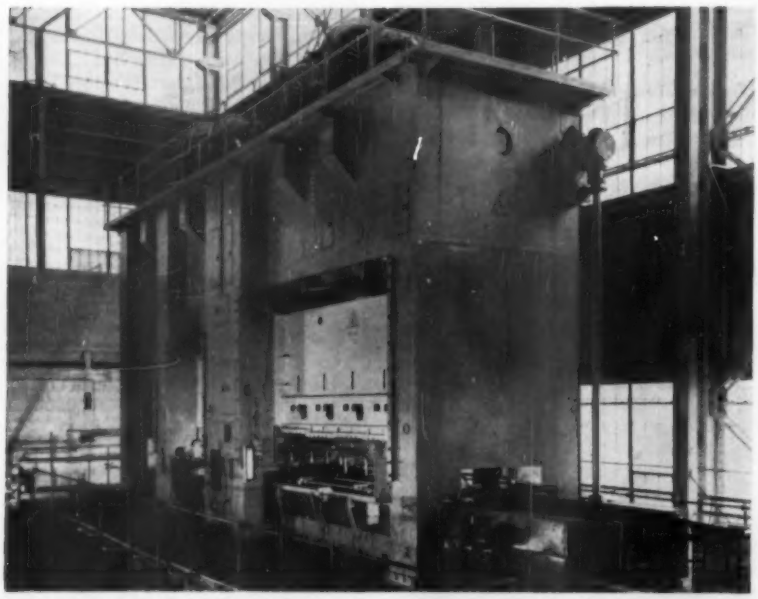
Charles C Cheyney, 68, vice president, sales, for the Buffalo Forge Co, died April 25 in Syracuse, NY.

New Shop Equipment



SEQUENCE OF OPERATIONS includes following steps: (1) blanks are loaded into stack feed, (2) double blank safety switch and positive stop, (3) draw—dryer, (4) draw—washer, (5) idle, (6) trim and pierce, (7) rewipe and extrude, (8) and (9) idle, (10) cam trim and pierce—both, (11) curl—washer, (12) cam flange—both, (13) cam notch restrike—washer, (14) embossing—dryer, and (15) turnover

Press Stamps Two Different Parts Without Changing Dies



CLEARING TRANSFLEX PRESS was built for the Washer, Dryer Div of General Electric, Louisville, Ky. Automatic clothes-washer tops and dryers tops are stamped out on alternate shifts

Modular Transflex press, built by Clearing Machine Corp for GE's Washer, Dryer Div, is 58 ft wide and 42 ft high, features an outstandingly flexible feed mechanism (*AM*—Mar 11 '57, p113), and is said to have the most unusual combination of slide arrangements ever assembled. When major changes in manufacturing are required, this press can be altered to suit the new conditions.

The machine illustrated produces two different pieceparts on alternate production runs without changing dies. Both automatic clothes-washer tops and dryer tops are stamped out on this press which incorporates two complete drive units, two crowns, two beds, four uprights, and five slides into a single machine. It has a transfer feed stroke of 40 in. and will produce over 700 stampings per hr. Washer tops are produced for 4 hr and then dryer tops for 4 hr; changeover requires only minutes using the split-side construction.

The press contains 15 stations, nine

of which are die stations. Of these nine, seven are used in production of washer tops and six for dryer tops. A specially designed hopper feed permits continual reloading of the press without skipping a productive stroke. An overhead crane is provided on the side of the press to load special baskets of blanks onto a rotary table which rotates 180° to bring the blanks under the hopper stack. A pneumatic cylinder pushes the blanks up into the stack frame. The blanks are raised one at a time by suction cups to the level of the transfer feed and fingers reach back to grip the stamping and move it on to station 2. Here a limit switch checks each blank for size. Press will stop if a seriously oversized blank or a double blank should come into station 2.

When dryer tops are being made, the slide adjustment in station 3 is run down to put this die in operation (and the adjustment in station 4 is run up). When washer tops are produced, station 4 is operating. The 10th through the 14th stations contain 5 dies, each mounted on a subslide which has an individual power-driven slide adjustment unit. Some of these sub-slides are used to withdraw dies from production. Completed stampings are dropped to a conveyor which carries them to subsequent manufacturing operations.

Changing production from one piece to another involves altering five electrical slide adjustments and turning two hand cranks. All slide adjustments are made by pushbuttons on master control panel. Key switch is set to "washer production" (or dryer production) and an automatic slide positioner button is pressed. All five adjustments operate simultaneously. Changeover time is about 10 min.

The Transflex feed is equipped with sets of fingers which move pieceparts from die to die through the press. When the dies open, fingers move inward to grip the parts; then move laterally to carry the part to the next station; then outward to release the part. While dies are closing, fingers move back to pick up next part. Length of feed stroke is adjustable; fingers are movable so as to match stroke length; cushions and knockout mechanisms are movable so that they may be adapted to various arrangements of die stations. The channels on which the fingers are mounted were made replaceable so that channels with entire sets of fingers, pre-adjusted to a particular set of dies, could be clamped in or out in minutes.

Other specifications: total capacity, 1600 tons; speed, 12 strokes per min; depth of pit required, 150 in. The left-hand section, consisting of two slides, has a capacity of 350 tons, 2 in. up on stroke, for each slide. Center section, two slides, has a capacity of 150 tons, 1 in. up on stroke, for each slide. The single slide of the right-hand section has a capacity of 600 tons, 1 in. up on stroke. Distance between stations is 40 in. The feed and transfer mechanism is driven from the press.

This modular design makes press automation available to the small manufacturer, to the job shop, for short runs and for multiple product output, as well as to the large manufacturer with requirements for volume quantities.

Clearing Machine Corp, 6499 W 65 St, Chicago 38, Ill

Press Control Prevents Tool and Die Damage Caused by Overload

Circuit Master, Mark II, is an electronic-mechanical control system designed for use on automatic equipment such as presses and molding machines equipped with solenoid or clutch-type release. Device is composed of a sensing assembly consisting of a compensating contactor mounted on stationary part of machine, and a bumper mounted on the movable part. Contactor is connected to control unit which contains visual indicator and, if desired, a switch.

Mechanism senses slightest mechanical overload: faulty stock, tool dullness or misalignment, misfeeds, jams, or non-ejection. It is self-adjusting and wear compensating, and is unaffected by normal temperature changes.

Wintriss, Inc, 20 Vandam St, New York 13, NY

...including

MACHINE TOOLS AND ATTACHMENTS

Bench Grinder 193
Vertical Milling Machine 200
Tool and Cutter Grinder 202
Lathe Block 224
Grinder Control System 228

TOOLS AND ACCESSORIES

Air-Operated Lock Hammer 194
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CLEANING AND FINISHING

Ultrasonic Cleaning Tank 193
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PLANT SERVICE EQUIPMENT

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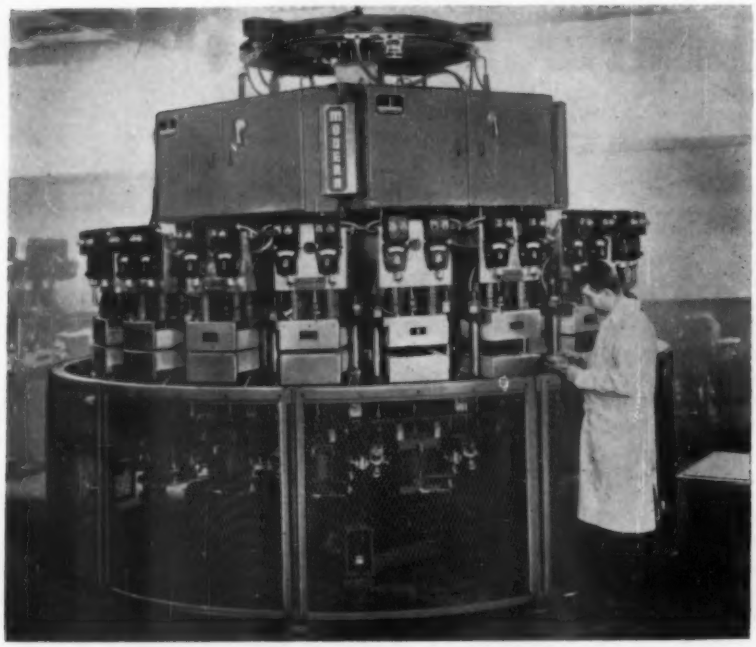
Fork Truck 200



Multi-Station Bonding Machines Control All Bonding Variables

Automatic multi-station rotary-cycle bonding machine (see cover) features positive control of all primary bonding factors, and is one of a series of machines ranging from single and multi-station stationary types to 40-station rotary types. It is designed for permanently bonding liners to either internal or external surfaces. Applications include the bonding of automatic transmission parts and brake-band linings or other components where two elements must be permanently joined together.

Line of machines is designed to offer complete control of all variables of any bonding method within the range and capacity of the machine's instrumentation for pressure regulation, time, and temperature. Production flexibility is provided through independently operated banks of stations.

Output for a single-station machine is about 10 parts per hr for a curing cycle of 6 min; for a 40-station machine, about 400 parts per hr. In one particularly difficult operation—bonding a cone-shaped liner to a conical surface while maintaining proper alignment—a 20-station bonding machine produced 200 units per hr. In this operation, parts (partially assembled in company's cold press, described later) are manually loaded and unloaded at one station of machine—all other operations are automatic. When liner and band assembly are placed in loading fixture, a peripheral stationary cam under the guard rail actuates an air valve that controls a double-acting air cylinder. This brings fixture into clamping position with a pressure of 200 psi at the bonding line. Pressure-control valve at each station can be adjusted for required pressure.

After partial rotation (10 to 15° from load position), pressure in the fixture is eased sufficiently to allow any entrapped gas between liner and cone to escape. Fixture then clamps again and remains clamped until the 6-min bonding cycle (a full machine circuit) is completed. A manual safety valve at each fixture permits operator to control clamping in case of part misalignment. Air pressure for clamping is manifolded to fixtures from 65-80 psi shop line.

Mandrel of clamping fixture is heated to 425 F by 110-v resistance heaters, five in both the upper and lower platen. Each section has a temperature indicator. Colored lights at each station indicate temperature stage—red for power, green when up to temperature. Thermostats maintain temperature, insulation reduces variations due to radiation.

Electrical operation is from a 440-v source to a standard bus bar mounted at the top of each machine—and through trolleys to one of several control panels. These panels, with voltage stepped down to 110 v, control a bank of five fixtures. Each bank of stations and fixtures can be electrically operated as an individual unit and all tooling is designed so that each station can be removed from machine for servicing without disturbing remaining stations.

A fractional-hp motor, through a Cone-Drive vertical speed reducer, drives the rotary table. Rotary speed is adjusted through variable-speed drive. Automatic lubrication is provided on all models.

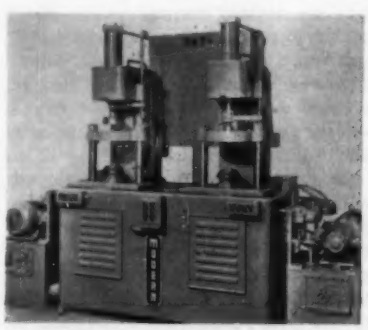
COLD-ASSEMBLING PRESS

Companion equipment to the line of bonding machines is a special 2-station cold-assembling press which turns out 200 joined-for-bonding parts per hr. Fixtures are custom-made for each application.

When used for the automatic transmission part (discussed previously), the press locates, positions, and preliminary bonds a cone-shaped molded liner to conical surface of a piston. Press operator places piston and liner, which has been pre-treated using oven-dried cement and a solvent activator, on lower platen of one station and manually positions them together. Both parts are held by a retaining collar. Automatic cycle now takes over with the press ram being lowered against an expandable neoprene mandrel to axially produce pressure about the entire liner area. This provides positive location and avoids any danger of securing liner in elliptoid position.

Holding pressure of about 400 psi is then applied by ram and maintained for a predetermined cycle. Ram return is automatic.

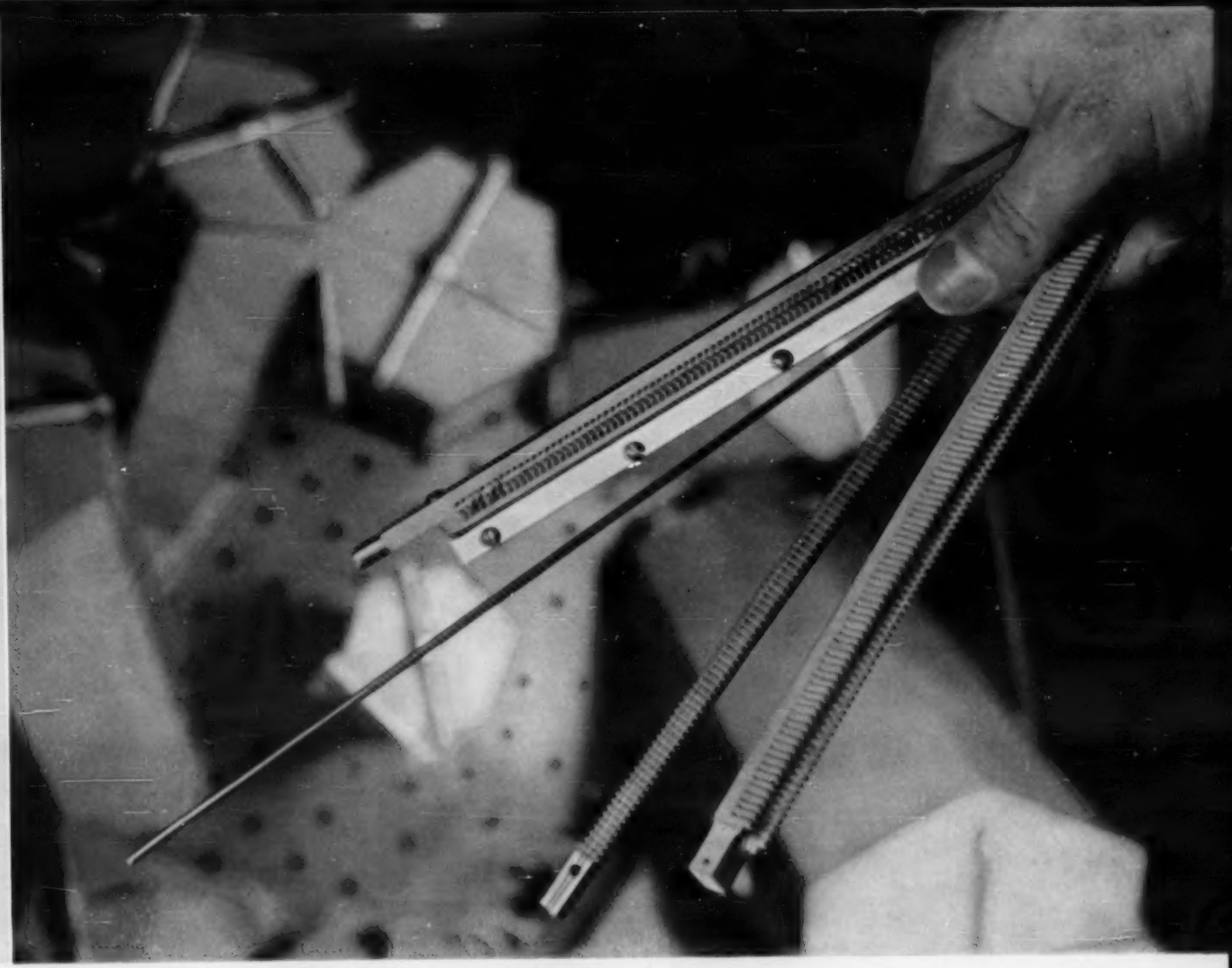
Modern Industrial Engineering Co, 14230 Birwood Ave, Detroit 38, Mich



Cold-assembling press, using manual loading and unloading and an automatic work cycle, supplies 200 parts per hr

Barrel Finishing... "on-spec"

For consistently more uniform finishes even on intricate metal parts like these, use Tumbling Grains by CARBORUNDUM. Fused aluminum oxide particles in CARBORUNDUM Tumbling Grains are tough and blocky... made to produce a continuous honing action for rapid stock removal or for ultra-fine finishes. In addition to tumbling grains, Carborundum also manufactures a complete line of abrasive tumbling media, including nuggets, and controlled vitrified and rubber bonded shapes. Ask your Carborundum Distributor or Salesman for a description of the wide variety of sizes available. Or write The Carborundum Company, Niagara Falls, New York, and ask for Booklet A-1461. In Canada: Canadian Carborundum Company, Ltd., Niagara Falls, Ontario.



Ask the man from **CARBORUNDUM** REGISTERED TRADE MARK **ELECTRO MINERALS DIVISION**

CARBORUNDUM ... also makers of a complete line of Bonded and Coated abrasives

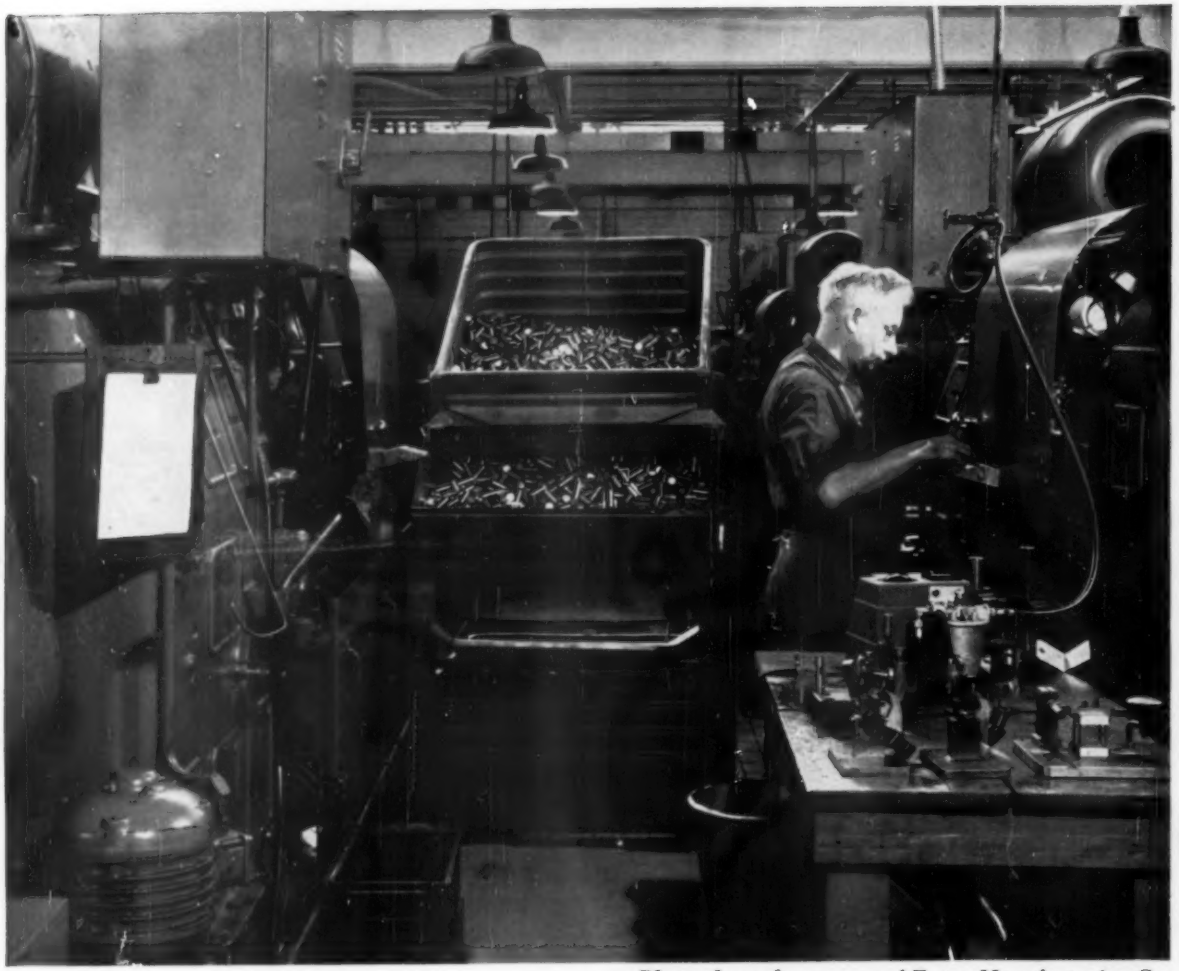


Photo through courtesy of Eaton Manufacturing Co.

MASS PRODUCTION means mass handling . . . and no other handling system can match the **Powell Flowmatic*** when it comes to smoothly and efficiently moving volume parts and materials in process. Watch it in action . . . talk with those using it and you'll understand why Flowmatic* is called the *"hottest thing in handling in a decade."* Literature upon request.

*Patent: No. 2762529

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POWELL PRESSED STEEL SINCE 1920

POWELL *flow-mation** SYSTEMS

The Powell Pressed Steel Co., Dept. 957, Hubbard, Ohio

King Hydraulic Presses Can Be Converted to Heavier Tonnages

Model 300A Series of hydraulic presses is designed so that it is possible to obtain a press with 65-ton capacity and to convert it later to as much as 300-ton capacity. Conversion kits cover 65, 125, 170, and 300-ton conversions. Series is supplied in these tonnages with self-contained hydraulic systems and controls or as basic units to be connected to a central system.

Specifications for all four capacities: platen dimensions, 26¾ x 32 in.; daylight opening, 25 in.; opening rate, 2.7 ips; closing rate, 1.55 ips, stroke, 12 in. Overall dimensions are 56 in. wide by 30 in. deep by 13 ft 4 in. high. Similar presses with greater width or double depth, in higher tonnage ratings, may also be supplied.

Other features: welded-steel, internally ribbed construction; extra-long bearing surface on upper platen; 8 adjustable bronze gibs on platen; packaged hydraulic system mounted in a tray on top of press; standardized cylinder components.

Presses are manufactured by King Machine & Mfg Co, Los Angeles, Calif.

Distributed by A Dale Herman, Inc, 17071 Ventura Blvd, Encino, Calif

Portable X-Ray Unit Has Low Weight-to-Power Ratio

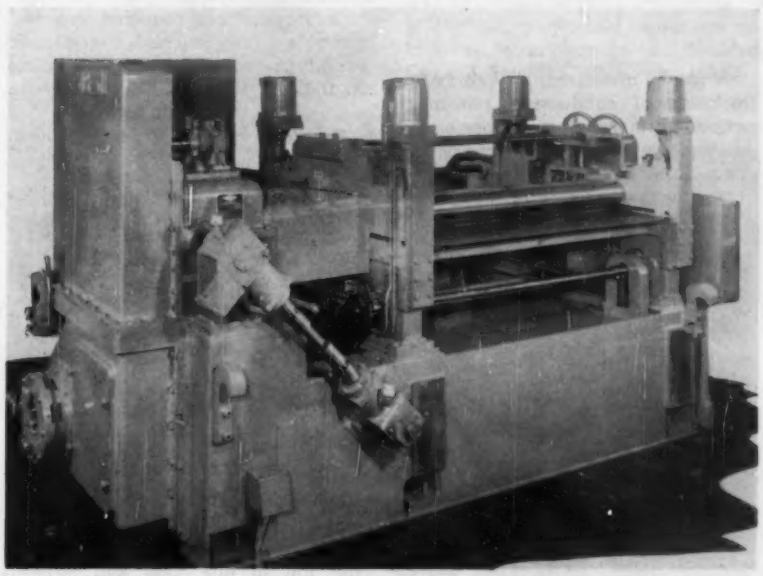
Baltoscope 200, a portable X-ray unit, has a rated capacity of 200,000 v and weighs 85 lb. Designed with low inherent filtration, unit is an all-purpose field unit which will handle materials from thin magnesium sheet to 3-in. steel. Head is waterproof, dustproof, and weatherproof. Automatic safety device makes unit safe and foolproof.

Balteau Electric Corp, Stamford, Conn

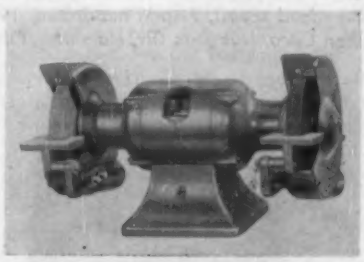
Branson Ultrasonic Cleaning Tank Cleans Long Items

Model S-1080 stainless steel tank is designed for conveyorization or for cleaning of long items, such as pipe. The tank is 10 ft long, 9 in. wide, 18 in. deep, has a working fluid volume of 75 gal of solution, and 16 type B-36 transducers give an effective cleaning area of 96 x 7½ in. Transducers are operated from company's 2-kw Sonogen generator, model APT-400-B

Branson Ultrasonic Corp, 37 Brown House Rd, Stamford, Conn



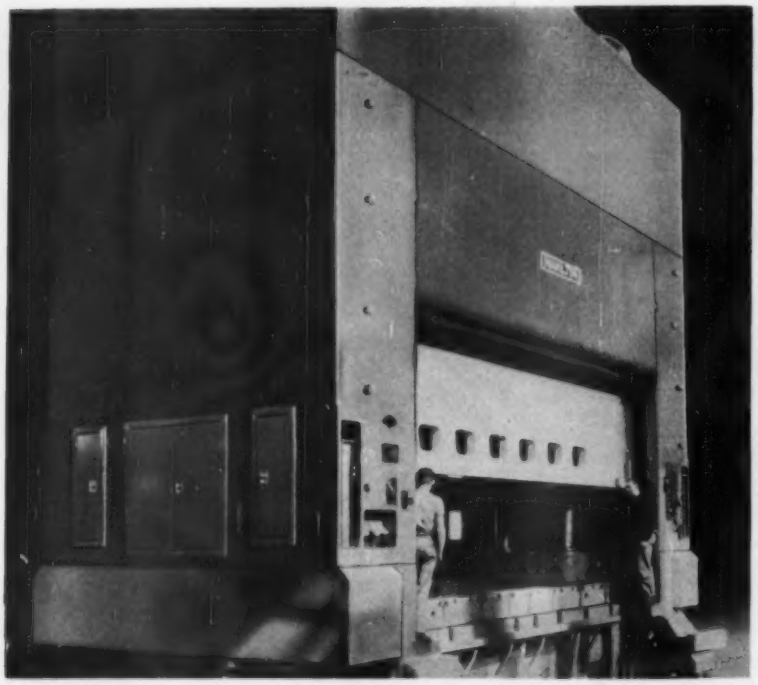
FEED LINE FOR DIE PRESSES is mechanically controlled, automatic unit consisting of a coil holder, decoiling unit, feeder unit, and an optional scrap shear. Line is applicable without modification to both progressive die operation and straight blanking, is electrically synchronized with the press, and can handle stock 0.125 in. thick by 60 in. wide and feed lengths up to 60 ft long—*McKay Machine Co, 285 W Federal St, Youngstown, Ohio*



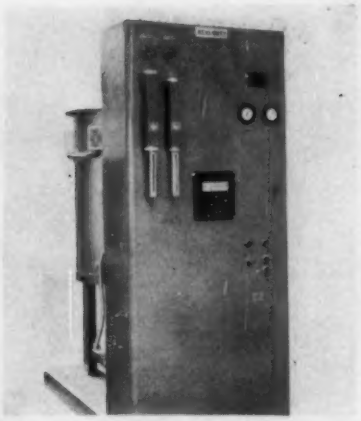
Stanley Grinder Grinds Large Odd-Shaped Pieces

No. 288 heavy-duty 8-in. grinder features extended frame construction, and is powered by a motor that has a smaller dia than the grinding wheels. These features make it an ideal unit for grinding large odd-shaped pieces. Safety wheel guards are drilled for company's eye-shields and have exhaust outlets and spark shields. Tool rests are fully adjustable for all-position grinding on wheel circumferences. Grinder comes equipped with cord, rubber feet, and one coarse and one fine wheel. Motor is ¾ hp, capacitor start and induction run.

Stanley Electric Tools Div, Stanley Works, New Britain, Conn



AUTOMOTIVE BODY STAMPINGS are handled on huge triple-action press at Ford Motor Co's Chicago Heights stamping plant. Designed with future production in mind, press—one of a pair—has bolster and blankholder dimensions of 200 by 100 in. Unit features bottom-drive construction; all three slides are actuated from single main drive and are mechanically synchronized. 800-ton blankholder moves down, holds blank; 800-ton inner slide moves down, makes draw; 550-ton lower slide moves up, makes reverse form or blanking operation. Standard speed, 9 spm; headroom, 19 ft; basement, 17 ft—*Baldwin-Lima-Hamilton Corp, Hamilton Div, Hamilton, Ohio*



Hevi-Duty Endothermic Generator Has 250-cfh Atmosphere Output

Model MK-524-EN endothermic generator is a compact unit consisting of a catalyst-filled heating chamber, gas pump, heat exchanger, and controls—all mounted on a steel frame. Unit produces 250 cu ft of atmosphere per hr. The atmosphere can be used in furnaces performing any of the following heat-treating processes: bright hardening of medium- and high-carbon steels and alloy-carbon steels, bright hardening of high-speed steels, annealing and normalizing, bright copper brazing, sintering and powder metallurgy processes, and carrier gas for carburizing and carbonitriding.

Only operations required once the generator has reached the proper operating temperatures are turning on the gas pump and adjusting the air and gas flows. Bulletin 157.

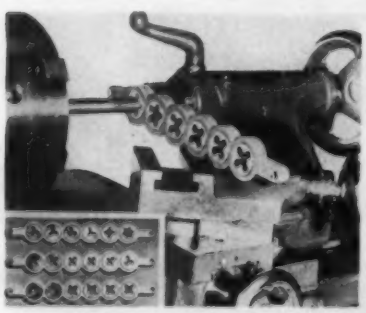
Hevi-Duty Electric Co, Milwaukee 1, Wis

Device Measures Plating and Film Thickness on Conductive Materials

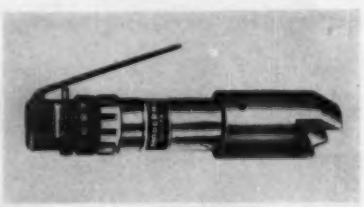
Electronic instrument, Type 255-A Film Gauge, can measure protective coating thicknesses of anodic films on anodized aluminum, magnesium, and other non-magnetic metals—including such insulating films as organic paints, porcelain, and enamel.

Unit can also be used to sort metals according to their conductivity, and to match metals according to their magnetic properties. Non-magnetic films on non-magnetic materials can be measured, as well as the thickness of conductive, non-magnetic materials such as copper on insulating materials such as glass, phenolic sheet, and ceramics.

Boonton Radio Corp, Boonton, NJ



SET OF THREE DIE-HOLDERS will cut 18 threads ⅛ to ½ in. in USS and SAE, plus ⅛ and ¼-in. pipe threads. Can be used on lathe, drillpress, or as a hand tool, as dies are always set in holder ready for use—*Mohr Tool & Mfg Co, Box 63, Maywood, Ill*



Air-Powered Lock Hammer Turns Sheet-Metal Locking Edges

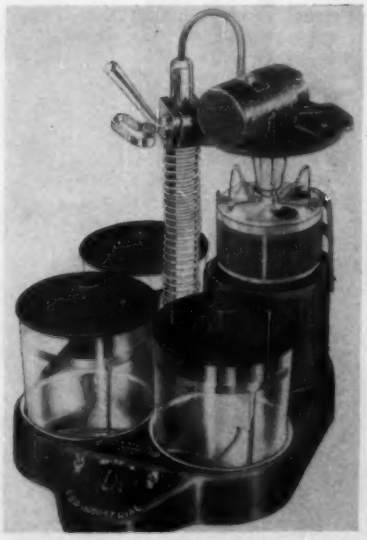
Air-powered Pittsburgh lock hammer reportedly turns any sheet-metal locking edge in seconds, doing the job in one pass and without dents. Unit handles 30 to 24 gage metal and is portable. Higher-capacity models are available on request.

Modern Mfg Co, Willow Grove, Penna

Metallizing Gun Applies Rokide Protective Coatings

Designed to apply Norton Rokide protective coatings, oxy-acetylene gun reduces the metal rod to molten particles at temperatures in excess of 5000 F and projects the molten particles at high velocity by compressed air onto the metal surface to be coated. Special deflection cap directs air to produce an atomizing angle of 45° or more. Company reports that one 24-in.-long aluminum oxide rod of ⅛-in. dia will cover, in 6 min, approx 25 sq in. 0.010 in. thick.

Metallizing Co of America, 3520 W Carroll Ave, Chicago 24, Ill



L & R Precision Cleaner Employs Centrifugal Action

Parts to be cleaned, rinsed, polished, and dried in precision cleaning machine are placed in work basket (divided into three sections by a triple nesting basket) which is attached to the motor-driven agitator shaft. Basket is then lowered into the first jar in the machine, and is rotated in cleaning solution for approx 3 min.

After cleaning operation, basket is raised and the excess cleaning solution is spun off by centrifugal action. The same operation is repeated in the 2nd and 3rd jars, which contain rinsing and finishing solutions. Then the basket is lowered into the drying chamber for approx 3 min until the rinsing solution evaporates.

Machine has dimensions of 23 x 16½ x 17¼ in. Monel-mesh work basket has 5½-in. ID, is 3⅜ in. deep.

L & R Mfg Co, 577 Elm St, Arlington, NJ

TROUGHING CONVEYOR, used for conveying liquids, chips, scrap, stampings, forgings, sand, or powder is hingeless, has stainless steel buckets, and has a min height from floor of 14 in. Length, width, and shape are determined by application—*R T Sheehan Co, PO Box 345, Plymouth, Mich*

200-Ton Hydraulic Press Has Infinitely Adjustable Pressure

Utility forcing press, designed for virtually any heavy metal forming or bending operation, has infinitely adjustable pressures right up to max 200-ton squeeze. It loads from any position within a 300° arc with all control and gages located so operator has absolute control.

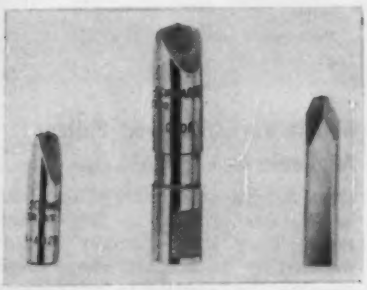
Press has downward speed of 140 ipm up to 14 tons counter pressure, 7¼ ipm between 14 and 150 tons, and a return speed of 250 ipm. Frame is of welded steel construction and houses two-stage pump, oil reservoir, and hydraulic system. Table and head are T-slotted.

Fjellman American, Inc, Joliet, Ill

Multi-Diameter Boring and Chamfering Combined in One Tool

Micro-adjustable boring tool using throwaway inserts combines multi-dia boring and chamfering operations. Each insert is locked on an adjustable anvil; each division of screw-dials represents 0.001 in. on dia. When inserts are dull, they are indexed to new cutting edge or interchanged. Boring bars are said to have wide range of uses on turret lathes, where precision finishes are required with minimum tool cost and downtime.

Wesson Co, 1220 Woodward Heights Blvd, Ferndale, Mich



SHAPED DIAMOND TOOLS, designed to produce the "pine tree" and other root sections of jet blades and buckets on two-wheel precision form grinders, uses a triangular-shaped macle diamond, held in tool shank by powdered-metal matrix material—*Craine-Schwartz Diamond Tool Co, 8100 Lyndon, Detroit 38, Mich*

Pratt & Whitney Introduces Six Specialty Gages

New line of specialty gages consists of:

Dual-Aire Air-O-Limit comparator, designed for use at machine on close tolerance grinding or lapping operations or close tolerance segregating, provides two magnifications simultaneously without switch-over. As finished size is approached, operator can observe high magnification scale and read size to within a few millionths.

Automatic Radial-Play Gage has capacity of 1200 pieces per hr and allows ball bearing manufacturers to maintain rigid quality control.

Sigmatic Multi-Dimension automatic gaging machine checks up to 50 dimensions simultaneously with extreme speed and accuracy.

Digital Read-Out Supermicrometer is said to reduce to minimum the element of human error. **Electrolimit Supermicrometer** is equipped with an Electrolimit tailstock, and is meant for lapping, fine machining, and grinding. **Tri-Rol thread comparator** is a production gage which duplicates the three-wire thread measurement method.

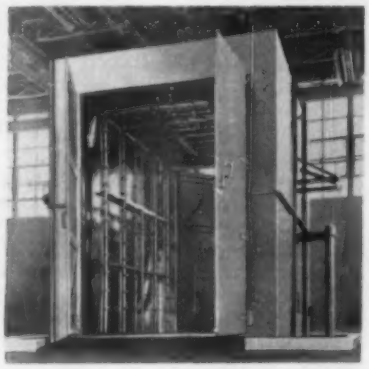
Pratt & Whitney Co, Inc, West Hartford 1, Conn

B Belt Variable-Speed Pulleys Available in 1 and 1½ hp

Pulleys with speed ratio of 2½:1 can be installed on old or new equipment. They are especially recommended for installation where speed changes are required to compensate for variations in production schedules.

Model 175 is rated at 2/3 hp at 1150 rpm and 1 hp at 1750 rpm; No. 180 at 1 hp at 1150 rpm and 1½ hp at 1750 rpm. Pitch diameter is 5.93 in.; length of bore is 2¾ in.

Lovejoy Flexible Coupling Co, 4966 West Lake St, Chicago 44, Ill

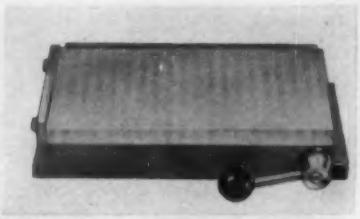


Washing and Processing Machine For Large, Odd-Size Products

Model A-F cabinet unit is equipped for automatically timed wash and rinse cycles. Signal light indicates when operation is completed. Combination cleaning and phosphate coating materials may be used in the wash tanks, and a small amount of chromic acid added to the rinse water provides a basic treatment that makes an excellent bond for paint.

Unit is installed in a pit at track level. Parts are loaded on specially designed trucks which are pushed into the cabinet. Clearance will accommodate a loaded truck 4 ft wide by 6½ ft high, and 10 ft long.

Alvey-Ferguson Co, Dept AM, 1203 Disney St, Cincinnati 9, Ohio

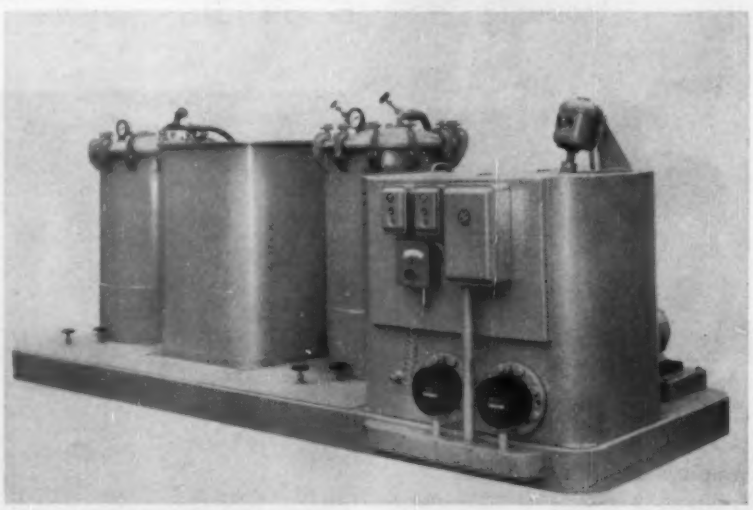


Magnetic Chuck Has All-Steel Top Plate, ¼-in.-Bar Poles

Permanent magnetic chuck, claimed to be lowest in the field, stands only 2⅜ in. high in the largest of three available models. Fine pole divisions and alternating magentic fields are said to reduce cutter magnetism to a point where chip adherence is no longer a problem. Weighing less than half as much as previous permanent chucks, device is available in three sizes: 6 x 10½ in., 6 x 12½ in., and 6 x 18½ in. The smaller models stand 2⅛ in. high, largest is only 2⅜ in. high.

Use of a new ceramic magnetic material reportedly gives this unit all the powerful characteristics of an electro-magnetic chuck. Dimensional stability is assured by the solid silver-brazed construction. Magnetically shielded bottom prevents magnetism from permeating into table. Prices range from $175 to $245.

O S Walker Co, Inc, Worcester 6, Mass



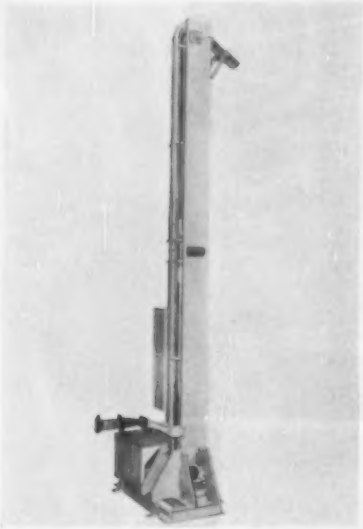
CASTING IMPREGNATOR, a low-pressure, vacuum-type unit, features a new design that eliminates sharp corners inside the tanks, allowing sealants to agitate without loss of solids into square corners. Machine uses a vented overflow system requiring only two water connections and one drain connection. Vacuum pump is capable of producing 29 in. of mercury in 4 min. Impregnator has a floor area of 12x4 ft, and operates on ac or dc, 115, 230, 450, or 560v—*Ideal Industries, Inc, Imprex Div, 2023 South 60th St, Milwaukee 19, Wis*

Ready, Set, GROW... with

REVERE ALUMINUM TUBE

For aluminum tube that is right for its purpose and comes to you right on schedule, call the nearest Revere Sales Office. Revere is headquarters for tube . . . seamless drawn, welded, lockseam and other types, in an extensive range of sizes, alloys and tempers, both round and other than round. It will pay you to tie the growth of your business to the most dependable sources of supply. Revere Copper and Brass Incorporated. Founded by Paul Revere in 1801. Executive Offices: 230 Park Avenue, New York 17, N. Y.

Revere Aluminum Mill Products include coiled and flat sheet, both plain and embossed, circles and blanks, Tube-In-Strip,* extruded products, all types of tube, rolled shapes, electrical conductors, forgings, foil, and frozen food containers. *Revere's trademark for sheet metal containing inflatable channels.

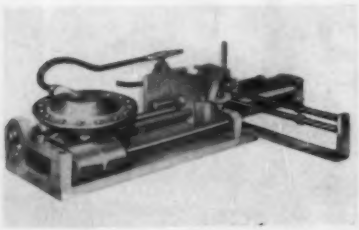


Automatic Elevating Conveyor Handles Short-Length Parts

Special Model 4500 accepts parts in a rolling position and minimum height of 20 in., elevates them to max 130 in. and feeds them into a production machine, assembly line, or packing unit.

Unit is equipped with adjustable speed drive and has a timing take-off from the cam mounted on lower shaft. Power is furnished by ¼-hp 220/440-v motor; floor space is 24 x 36 in.

Feedall, Inc, Willoughby, Ohio



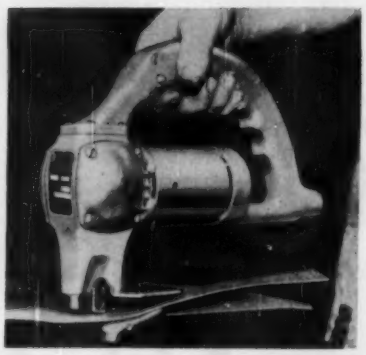
Air-Operated Device Feeds Coiled Stock to Punchpress

Ses-Matic air feeds can easily be moved from press to press, and require no expensive mounting fixtures. These units are designed for direct mounting to the bolster plate of the press; only other tie-in necessary with the press is the mounting of a valve in a manner whereby it will be tripped by some moving part of the press ram or die.

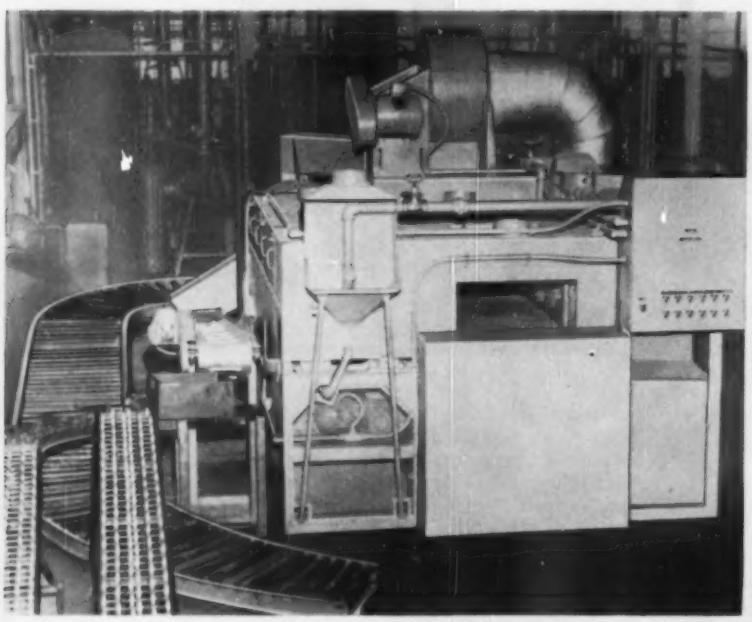
Feeds are available for max stock widths of 8, 12, and 18 in.; max feed stroke lengths of 8, 12, and 18 in. They are adjustable for both width and stroke length from 0 to max. Thicknesses of stock handled depends on width; specifically 5/32 in. thick up to 8 in. wide, 0.125 in. thick up to 12 in., 0.093 in. thick up to 18 in. wide.

In operation, coiled stock is guided at front and rear of feeder. On signal from press, a diaphragm gripper assembly grips the stock with approx 1600 psi pressure along one edge then pulls stock forward to end of feed stroke, where it is released. Stock is always fed on the up-stroke of the press. Metal-to-metal stops insure close-tolerance duplication of stroke length at every cycle.

Special Engineering Service, Inc, 8161 Livernois Ave, Detroit 4, Mich



SHEAR, No. 16, cuts all types of sheet metal and wire netting, cutting through cold rolled steel at speeds up to 30 fpm. Deflector plate prevents curling, and eliminates other possible fouling of material. Tool weighs 6¾ lb—*Black & Decker Mfg Co, Towson 4, Md*



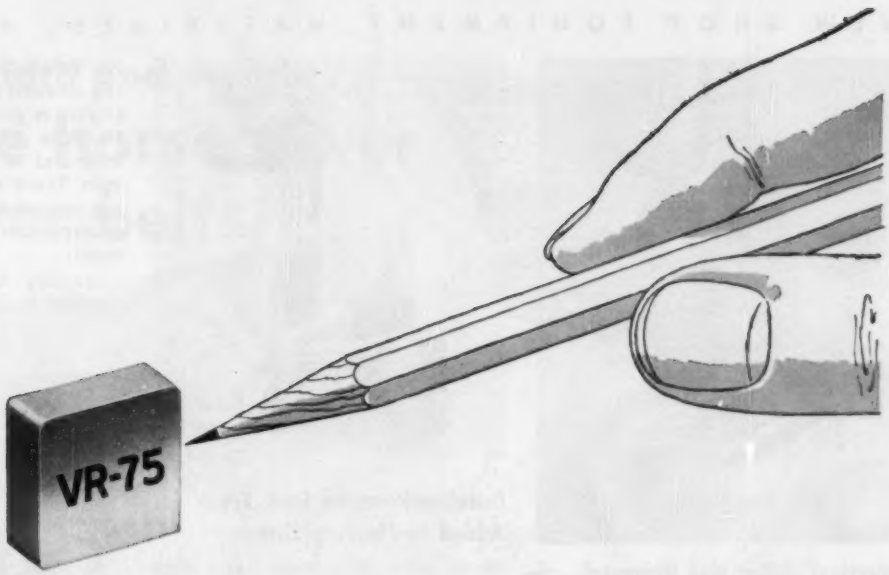
DRUM AND BELT-CONVEYOR-TYPE CLEANING MACHINE cleans small work or parts and is adaptable to pickling, phosphating, or neutralizing. Small pieces are washed, rinsed, and dried in drum section and larger work or tote pans are processed in conveyor section at same time. Same pumps, tanks, blower, and heaters serve both sides of unit. Return conveyors allow one-man operation—*Ransohoff, Inc, Hamilton, Ohio*

Weldalloy Process Forms Strong Bond Between Carbide and Steel

Weldalloy process is said to join carbide to steel in a union strong enough to withstand use in punchpress operations. Bonding material, also called Weldalloy, is made in two series, Weldalloy A and B. Weldalloy A is used as intermediate joining material between carbide and steel. Hardness can be varied from R_c20 to R_c50. Heat treatment after joining will bring entire piece to desired hardness.

Weldalloy B alloys are used as casing materials to reinforce carbide inserts. Hardness range is R_c80-100, as molded. Company uses process for any grade of carbide on inserts of its own manufacture or carbides procured from other manufacturers.

Welded Carbide Tool Co, Inc, 62-68 Colfax Ave, Clifton, NJ



. . . a new Super Steel-Cutting Carbide Grade

field-proven on all types of work!

1½ to 2½ times greater tool life on crankshaft cheeking. Material SAE 1145 steel forging, 217-251 Brinell. Feed .013, SFPM 250. Toolholder with triangular full length insert. Severe interrupted cut.

Carbide	Insert life, average
Premium Grade "A"	125 pieces per corner
Premium Grade "B"	188 pieces per corner
VR-75	324 pieces per corner

81% greater tool life turning *Arma-steel forging*, 35-38 Rockwell C. Machine, Sundstrand automatic; feed .010; SFPM 400; depth of cut ⅛"—¼"; toolholder with triangular throw-away insert.

Carbide	Pieces Per Corner		
	Min.	Max.	Aver.
Premium Grade "B"	68	122	85
VR-75	115	211	160

Tool life doubled turning spline coupling. Machine, New Britain copy lathe; feed .020; speed 940 rpm; depth of cut 3/16". Negative rake toolholder with triangular throw-away insert.

Carbide	Pieces per corner
Premium Grade "B"	120 average
VR-75	240 average

4 to 1 tool life turning spline end of axle shaft. Machine, Bullard Man-Au-Trol; material SAE 1330 steel, 340-360 Brinell; speed 290 sfpm; feed .0133. Toolholder with triangular long insert.

Carbide	Pieces per corner	Edge Wear
Premium Grade "A"	45	.050
VR-75	187	.040

AVAILABLE NOW in throw-away and long inserts for negative rake toolholders. Ask for Bulletin No. 572.

Call your V-R representative or distributor or write.

Vascoloy-Ramet Corporation

Subsidiary of Fansteel Metallurgical Corporation
816 S. Market St., Waukegan, Illinois

C-626

Vertical Miller Has Universal Head, Five Spindle Speeds

Rotex vertical milling machine, Model VM, has an all-angle vertical head, T-slotted table, large, easy reading dials, and a storage cabinet. Working surface of the table is 20 x 5 in. with a longitudinal travel of 12 in. Five spindle speeds range from 390 to 5200 rpm.

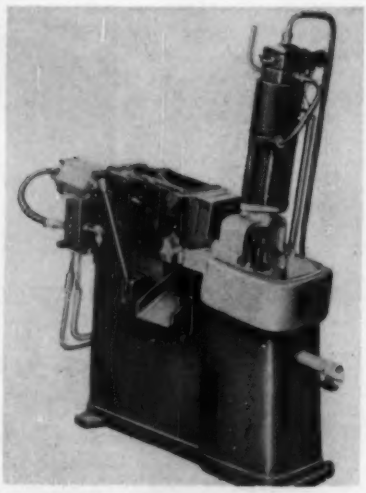
Rotex Punch Co, Inc, 2350 Alvarado St, San Leandro, Calif

Gasoline-Powered Fork Truck Added to Mercury Line

Model 430-G fork truck has a 4000-lb capacity and features ease of operation and maintenance. Some of the time saving features are: easily replaceable clutch, removable seat and side-plates, hinged hood, conveniently located operating valves, top and bottom inspection covers for drive axle.

Truck is available with either Duoscopic (2 to 1 ratio) or Triscopic (3 to 1 ratio for extra high free-lift) hoist system. One single-acting low-pressure cylinder elevates lifting element and forks. Four cylinder engine is governed at 2000 rpm and provides 120 ft-lb torque at 1200 rpm and 40 brake hp at governed rpm. Truck can be equipped for LP-gas operation and an automatic-type transmission will be optional equipment.

Mercury Mfg Co, 4044 S Halsted, Chicago 9, Ill

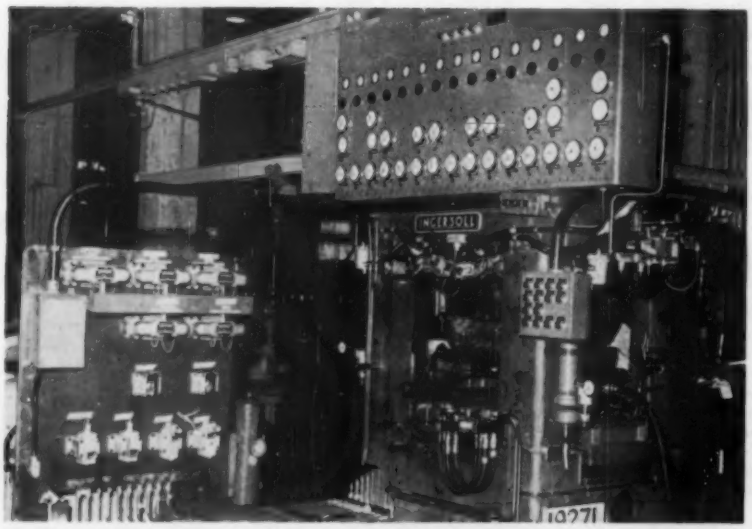


British Die-Casting Machine Offered in High-Speed Model

Latest model of the DCMT IMP/96 has max shot capacity of 1 lb; it can cycle continuously for lengthy periods at free cycling speeds up to 3000 shots per hr.

Machine is designed in units so that any part may be rapidly removed and replaced. DCMT system of prefabricated die blocks is used.

British Machines & Foundry Supplies, Ltd, Dept PR-21, Port Washington, NY



AUTOMOTIVE ENGINE BLOCKS are checked and classified on this gaging and transfer machine which checks 20 ID's—2 each in five crankshaft bores and 2 each in five camshaft bores. In addition, alignment of oil holes in five bearing liners with holes in bores is checked. Machine stamps plus or minus sign on each end of block to indicate whether No. 1 and No. 5 crankshaft bores are above or below nominal size within tolerance limits. If limits are exceeded, block is shunted out of line. Handling, positioning and control portions of machine, which handles 95 blocks per hr, are made by Ingersoll Milling Machine Co, Rockford, Ill—*Federal Products Corp, 1144 Eddy St, Providence 1, R I*

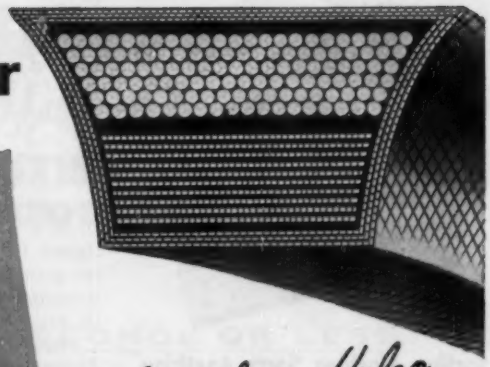
Aluminum-Cutting End Mill Minimizes Chip Adherence

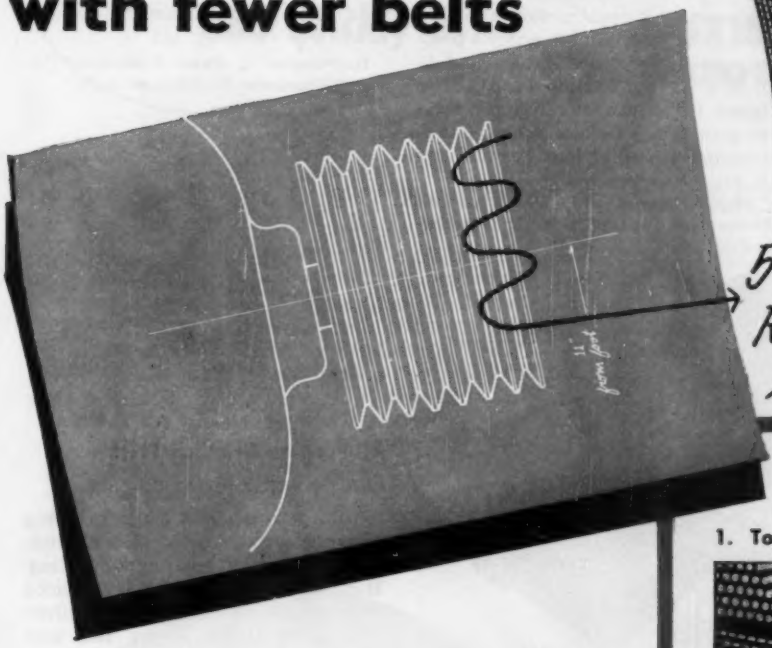
Ski-Kut end mills, designed especially for cutting aluminum, have a narrow primary-flute face which is said to reduce adherence of chips to flute face. Helix angle of 45° makes possible a smoother shearing action. Other advantages claimed are greater feeds, longer tool life, less horsepower required. End mills are available from stock in sizes from ¼ to 2 in. in various lengths. Bulletin SKM-1.

Weldon Tool Co, 3000 Woodhill Rd, Cleveland 4, Ohio

Cut sheave width and weight...

get same horsepower with fewer belts





5 Gates Super Vulco Ropes do the work of 7 standard V-belts

Where space is limited and weight a factor, design your drive with this important fact in mind:

5 Gates Super Vulco Ropes do the work of 7 standard V-belts

That's because a Gates Super Vulco Rope has 40% more horsepower capacity — delivers more horsepower per dollar invested than any standard V-belt drive. Sheaves with fewer grooves cost less . . . weigh less . . . take less room. Drive design is invariably improved.

A wealth of drive data is quickly available to you. Simply call your nearby Gates distributor for a Gates V-belt specialist. Stocks carried in industrial centers around the world.

The Gates Rubber Company
Denver, Colorado

GATES Distributors are in the Yellow Pages

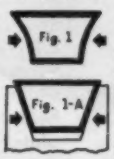
The Mark of Gates Specialized Research

No other V-Belt has ALL these advantages

1. Tough, resilient Tensile Cords

Super strong resilient tensile cords provide 40% greater horsepower capacity . . . easily absorb heavy shock loads . . . reduce number of belts required . . . save weight and space.

2. Concave Sidewalls (U.S. Pat. 1813698)



Concave sides (Fig. 1) increase belt life. As belt bends, concave sidewalls become straight, making uniform contact with sheave groove (Fig. 1-A). Uniform contact means less wear on sides of belt . . . far longer belt life.

3. Flex-Weave Cover (U.S. Pat. 2519590)

A Gates exclusive: provides greater flexibility with far less stress on fabric. Cover wears longer . . . increases belt life . . . more power available to driven machine.

4. High Electrical Conductivity

Built into Gates Super Vulco Ropes for safer drives (in explosive atmospheres).

5. Oil, Heat, Weather Resistant

Special rubber compounds make Super Vulco Ropes highly resistant to heat, oil, and prolonged exposure to weather.

TPA 248

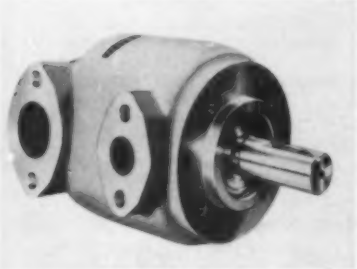
Gates Super VULCO ROPE Drives

Sorting Machine Sorts Anything From Bearing Balls to Gears

Autosorter will sort anything from bearing balls to gears and piston pins into as many as 13 categories. Device is based on no-drift electronic principle of gaging plus a new and simple mechanical memory system. The same machine can be used for increments anywhere from 0.000010 to 0.010 in. Accuracy between classes is guaranteed as low as 0.000002 in. Speed range averages around 10,000 pieces per hr, depending on size and type of piece.

To change to different type workpieces, top portion containing mechanical feeding and positioning elements is removed and replaced in 5 to 10 min by means of three cap screws. For visual inspection of balls and rollers, a stroboscopic light in window indicates out-of-roundness.

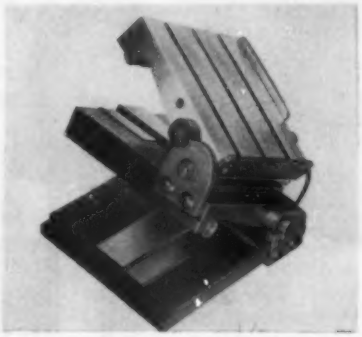
Industrial Gauges Corp, EAM Div, West Englewood, NJ



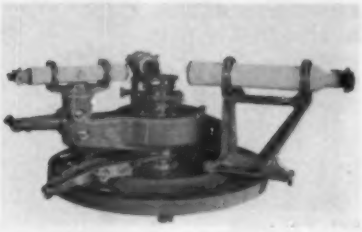
Denison Pumps Rotate in Either Direction, Have Balanced Vanes

Balanced vane hydraulic pumps of new T Series have rated deliveries up to 100 gpm and speeds up to 1800 rpm. Shaft rotation is changed by indexing the cam ring to the dowel pin hole with arrow indicating desired direction of rotation. Pump consists of housing which provides an outlet connection, a bore for support of shaft bearing and assembly, and a larger bore which contains floating pumping cartridge consisting of a front port plate, vane, rotor and cam ring assembly, and rear port plate. Balanced vane is achieved by a construction allowing vane to be open at both ends to pressure on the pressure stroke, and to suction on the suction stroke. Designed for continuous 2000-psi service, pumps may be face, foot or flange mounted in any of four positions on its mounting bracket.

Denison Engineering Div, American Brake Shoe Co, 1160 Dublin Rd, Columbus 16, Ohio



COMPOUND SINE PLATE, Model 1905, allows setting up of both compound and single angles. Unit has special alloy-iron bodies and the rolls are hardened and ground to same dia within 0.0001 in.; other dimensions are held to tolerance of 0.0002 in. Top plate is 6¼ in. square and has 3 T-slots. Base and middle plate each have 0.2000-in. recess. Unit comes in oak case—*Bald Eagle Corp, 356 Cedar St, St Paul 1, Minn*

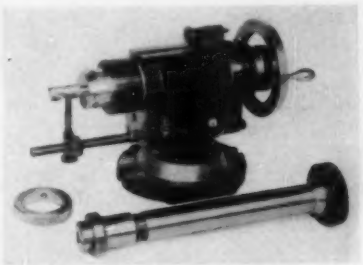


Instrument Checks Gage Block Setups, Instrument Assemblies

Guild-Watts Spectrometer has two telescopes, one on main bearing and one on a pillar, and a pillar-mounted collimator which has a larger-diameter objective and longer focal length than the telescope objectives. One divided circle is used to read both table and telescope positions. Circle reading corrects centering errors, and is direct to 0.1 second.

An auto-collimating eyepiece, which permits the telescope to be used as an auto-collimator, is available.

Distributed by Engis Equipment Co, 431 S Dearborn St, Chicago 5, Ill



All-Purpose Grinding Fixture Can Do Index Grinding

All-Purpose tool and cutter grinding fixture can be set up for index grinding, radial relief, and finger grinding. Handwheel has 24 equally spaced holes on one side and 35 on the other. This combination offers the user from 1 to 11 positions. Base is graduated from 0 to 90° in both directions. Capacity ranges from 0 to 1½ in.

For radial relief work, spring-loaded head causes spindle or quill to ride the cam. Cams can be supplied for any numbers of degrees or flutes. For finger follow-up reproduction operations, unit requires no centers or lead cams.

S & D Engineering Co, 2051 W Mountain St, Glendale 1, Calif

LP-Gas Conversion Kit Approved for Lift-Trucks

Kit for converting gasoline-powered lift-trucks to LP-gas consists of a fuel tank, fuel filter, converter-regulator, carburetor, solenoid safety shut-off valve, relief valve, necessary hoses and connections, and bears an Underwriters' Laboratory listing for "approval by report" of a field installation. Each kit supplied to user bears a serial number which gives certification that the conversion, if applied according to proper procedures, meets UL specifications.

Yale Materials Handling Div, Yale & Towne Mfg Co, 11,000 Roosevelt Blvd, Philadelphia 15, Penna

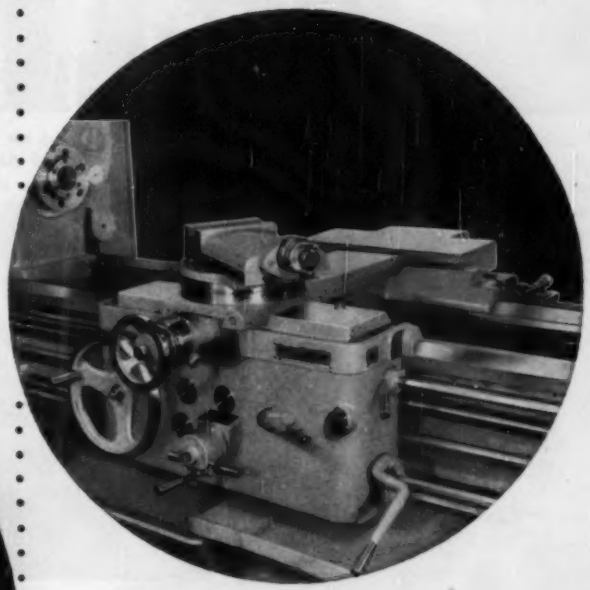
no other lathe shifts as easily and quickly as...

SIDNEY
DIAL-MASTER
LATHE
MODEL 32

FROM SPEED TO SPEED IN 2 SECONDS OR LESS!

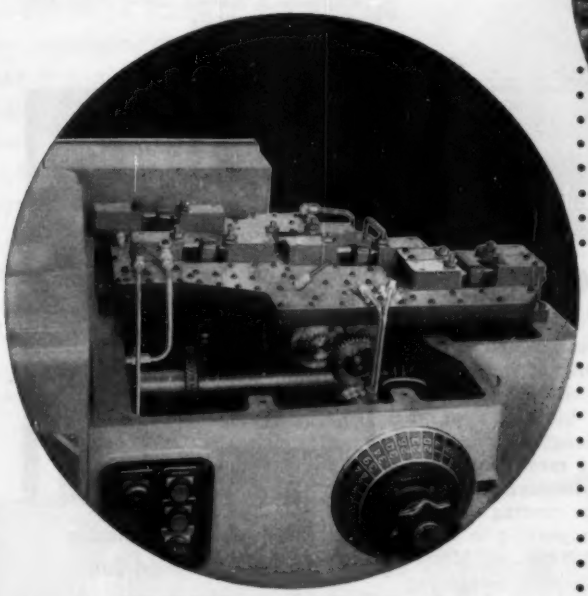
A flick of the control lever and you change to any speed through the hydraulically actuated shifter mechanism. The all-herringbone geared headstock provides 32 pre-selective spindle speeds (this was introducted FIRST by Sidney in 1947) in geometric progression all obtained by the rotating dial control. Think of the time and effort saved!

In addition, you get great strength and smooth operation in the headstock. The herringbone gears eliminate end thrust and provide longer life due to the opposed helix angle and greater tooth engagement.



SINGLE LEVER CONTROL CARRIAGE AND APRON

No complicated mechanism to worry about. Control for both standard longitudinal and crossfeed as well as 4-way rapid traverse is through a single lever which actuates positive serrated jaw plates. Safety overload feature is provided. Interlocking mechanism prevents use of the feed gearing when half nuts are engaged. Built-in thread chasing dial is mounted at angle convenient to operator's vision.

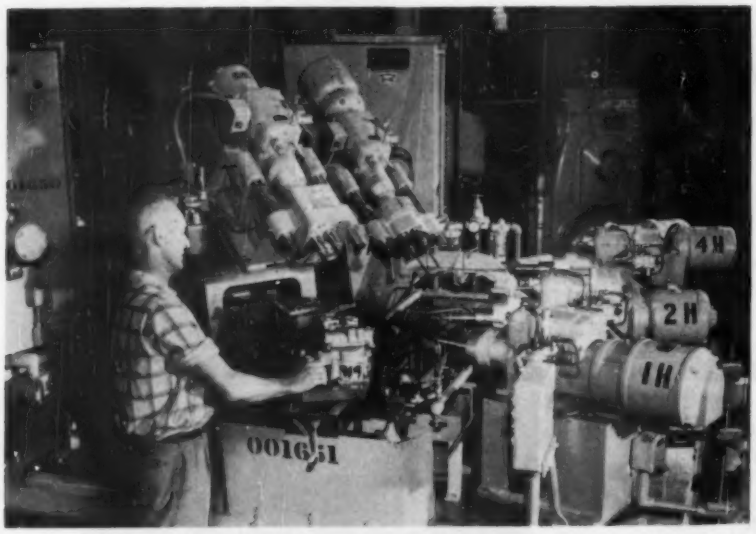


32 PRE-SELECTIVE SPINDLE SPEEDS

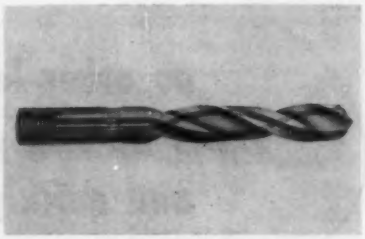
Write for new bulletins or for representative to call

THE SIDNEY MACHINE TOOL CO. • SIDNEY, OHIO

Builders of Precision Machinery since 1904



TURBINE ENGINE FUEL CONTROL HOUSINGS are drilled on automatic multiple drilling machines at Hamilton Standard Div of United Aircraft, Windsor Locks, Conn. Holes of varying size, angle, and depth are drilled in upper and lower housings. Number of operations performed by each machine varies from five to 13, with the machines eventually accounting for 112 operations *—Hartford Special Machine Co, Hartford, Conn*

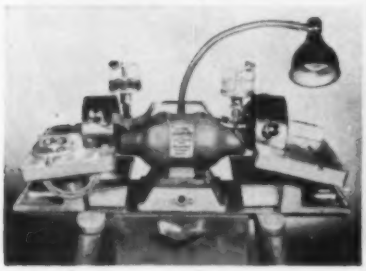


High-Speed Oil-Hole Drills Are Offered by Whitman & Barnes

Designed for use on production runs on screw machines or turret lathes, high-speed oil-hole drills feature continuous holes drilled through the body and shank of the tool. This construction permits lubricant or air to pass freely to the drill point, where it acts as a coolant as well as a force to eject chips and dirt.

Drills are regularly stocked in straight-shank taper-length sizes from 7/16 to 1½ in. by 64ths. Shank ends are tapped for use with threaded-pipe connections or can be made to fit special requirements. Taper-shank, extra-length, and larger-diameter drills can also be furnished on request.

Whitman & Barnes, 40600 Plymouth Rd, Plymouth, Mich

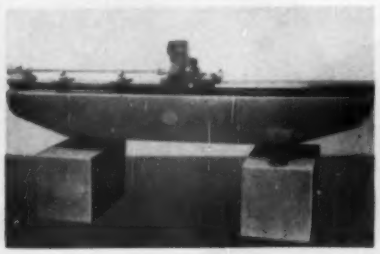


Carbide Tool Grinder Features Efficient Cooling System

Thorough wheel coolant and cutting-oil feed with sight-measured drip control are provided in new Coolie-Grinderlap carbide tool grinder. This single-point carbide tool and carbide drill grinder also has a 6-in. 60-grit roughing green wheel and a 6-in. diamond finishing wheel, 325 screen, mounted on opposite ends of motor shaft.

Tilt of worktables is controlled by compression spring and is adjustable by tapping the extremes, the segment indicator showing the angle of tilt. Two models are available: Model O1 weighs 60 lb and has a 1/3-hp single-phase capacitor-type reversible motor, Model OX, 73 lb, is same machine with a ½-hp motor. Both motors turn at 3450 rpm.

Diamond Tool Co, South Haven, Mich

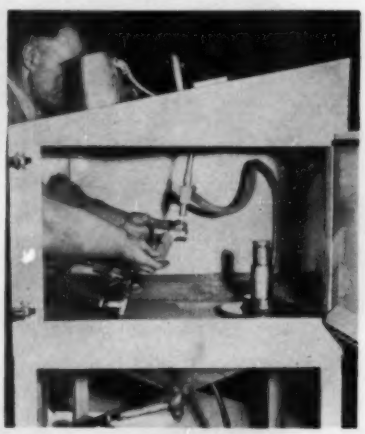


Device Reads to 0.00005 in. For Lengths up to 10 ft

Watts machines are designed to give precise measurements of lengths and diameters beyond the size capacity of practical gage blocks. Type A (illustrated), for lengths from 80 to 120 in., consists of measuring head which contains a 4-in. precision glass scale with projector reading directly to 0.00005 in. and repeating to a setting accuracy of 0.00001 in. Microscope sets instrument's measuring head to the master scale's 4-in. graduations. Scale is housed in protecting channel at center of machine, directly below work.

Type B, for measuring to 0.0001 in. at 30 ft, has a sectional bed and a steel master tape under constant tension. Work supports, coarse external scale, and support plates complete the standard equipment.

Distributed by Engis Equipment Co, 431 S Dearborn St, Chicago 5, Ill



Sandblast Cabinet Is Available With Trigger-Controlled Gun

Sandblasting cabinet may be used either with its adjustable-mounted blast unit or with a trigger-controlled hand blast gun which is optional equipment. Mounted blast unit may be raised or lowered to suit the workpiece. Gun unit is ideal for blasting angles and crevices. The blast action of the mounted unit is controlled by stop-start foot valve.

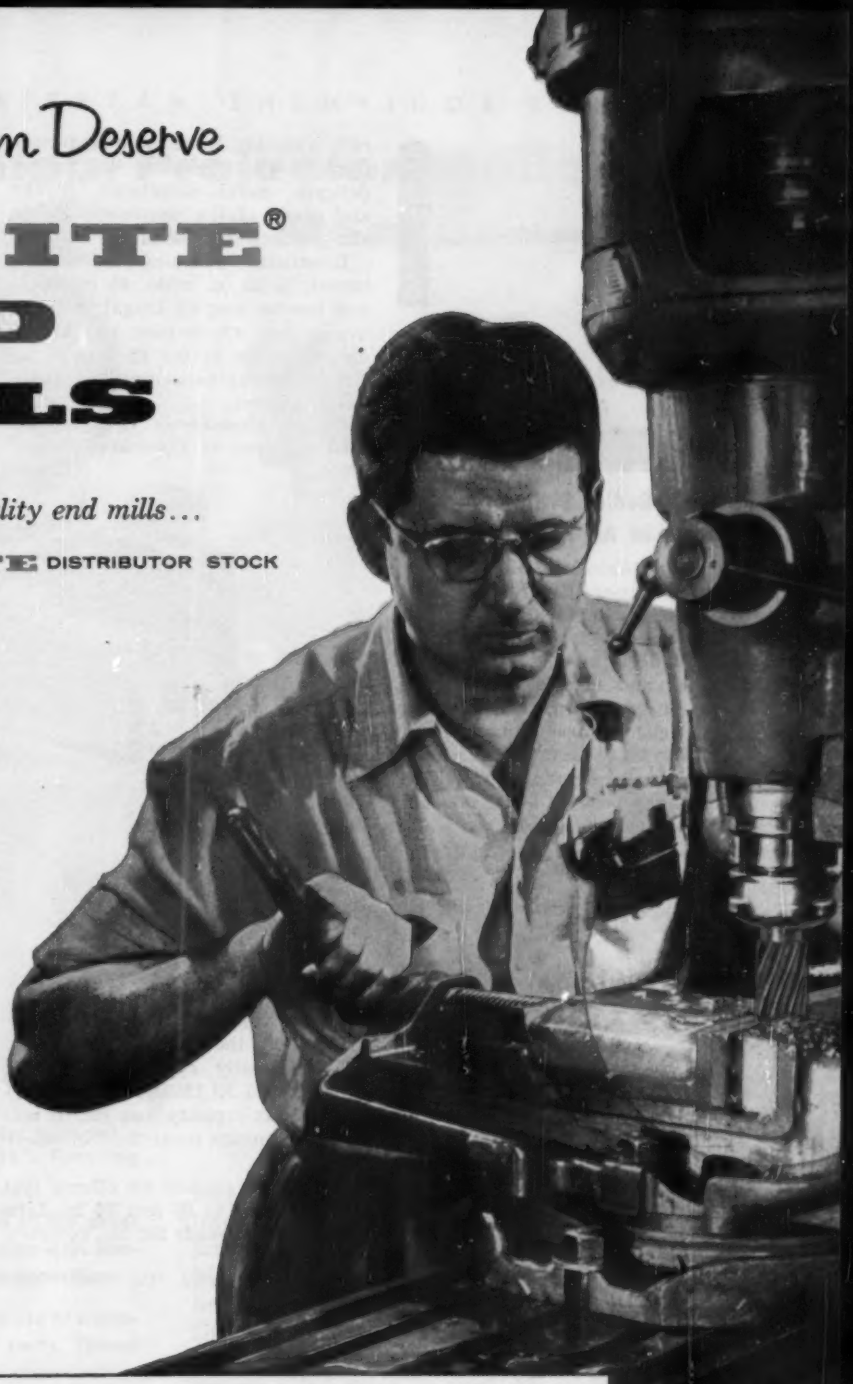
Cyclone Sandblast Equipment, 42 Clara St, San Francisco, Calif

Expert Workmen Deserve

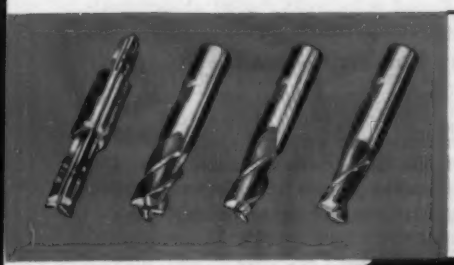
ILLINITE® END MILLS

the complete line of premium-quality end mills...

AVAILABLE FROM ILLINITE DISTRIBUTOR STOCK

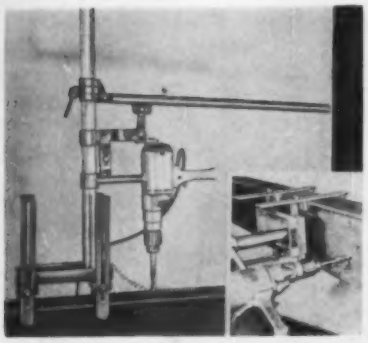


Skilled hands demand accurate tooling to get the most out of modern, high speed equipment. Every ILLINITE End Mill is engineered to exacting tolerances for clean metal removal. All flutes are fine-finished to prevent clogging. Available in thirty-eight different styles and in a full size range, ILLINITE End Mills are your assurance of consistent performance with maximum savings for every application. Illinois Tool Works research creates new tools, such as Tri-Mil End Mills, to offer industry the best possible line of standard metal cutting tools. And, they're only a phone call away. Call your ILLINITE distributor today. You'll be glad you did!



ILLINITE®
Metal Cutting Tools
DIVISION OF ILLINOIS TOOL WORKS
2501 N. Keeler Ave., Chicago 39, Illinois

itw



Portable Radial Drillpress Operates in All Positions

Lance portable radial drillpress eliminates necessity for handling large pieces, unwieldy tools, and turning pieces for further operations. Made of steel, unit swings in 360° arc and clamps on any size, shape, or type of metal workpiece. It is designed for use with any standard, heavy-duty portable drill, either electric or air-operated, and will operate in any position—vertical, horizontal, overhead, or flat.

Lance Iron Works, Box 310R3, Chicago Heights, Ill

Lemert Dimpling Machine Works New High Temperature Alloys

Airflex Camtrol Model C-125, designed for airframe manufacturers, handles not only the softer alloys but the newest 17-7 PH and 15-7 Mo stainless steels as well as vanadium and manganese alloys of titanium.

Machine can spin-impact pierce through 0.150 in., spin-impact rivet through ⅜ in., pneudraulic squeeze rivet and pierce through 13 ton. Operation does not use heat as does ram dimpling. It uses high-frequency impacts plus spinning to reform delicate metal structures. Stroke and speed of the pneumatic piston are precisely regulated.

Illustrated machine has 24-in. throat, is 20 in. wide, 46 in. deep, and has an over-all height of 70 in. Throat has 4⅞-in.-max gap and a clearance die to die of 2-15/16 in. Larger throat capacities are available on order.

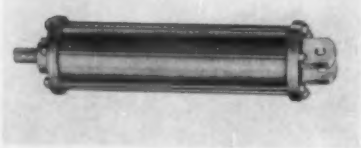
Lemert Engineering Co, Inc, 201 East Jefferson St, Plymouth, Mich

Electric-Hydraulic Lifts Are Added to Crown Line

Line of Crown E-Z lifts has been expanded by the addition of a series of electrically operated hydraulic lifts. Model RL1250-56 (illustrated) is a 1250-lb-capacity fork lift. It will raise maximum loads to 56 in. above the floor.

Two other models are offered that lift loads up to 66 and 76 in. Lifts are delivered ready for use, complete with battery.

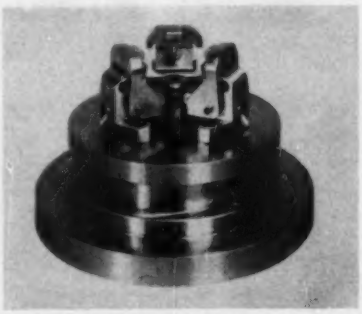
Crown Controls Co, Inc, New Bremen, Ohio



Heavy-Duty Air Cylinder Available in Strokes up to 18 ft

Densmore air cylinders are available in strokes up to 18 ft, from 3 through 8-in. bore with a wide range of piston rod sizes. The cylinders feature capsule type glands, V-ring packings which can be adjusted by hand, tiebolt construction, and ease of disassembly. Static seals are standard O-rings. Operating pressures are 150 psi on air and 500 psi in hydraulic service.

Densmore Engineering Co, Inc, 235 E Greenleaf St, Compton, Calif



Splinemaster Bevel-Gear Chuck Has Rotating-Ball Locator Pin

A self-contained unit with cylinder and mounting plate, Splinemaster bevel-gear chuck features locator pin that has a free-rotating contact ball automatically adjusting to a new contact point with each loading and unloading of work. Company reports that tests indicated wear on the ball of only 0.0006 in. during production use of the chuck; the ball reportedly remained a perfect sphere.

Locator pin can also be used in chucks of other manufacture. Company stresses economy of pin: Subsequent cost involves only replacement of the ball.

Chuck body is constructed for locking pin-holding blocks in a variety of positions. Chuck can be used for either OD or ID operations.

Splinemaster Products Co, 6781 Maxwell, Van Dyke, Mich

High-Temperature Brazing Alloy For Stainless, High-Alloy Steels

Nickel-chrome-boron high temperature brazing alloy, known as Nicrobraz, is one of series of special alloys for use in brazing of stainless and high-alloy steels. Series features high tensile and shear strength, and reportedly has excellent corrosion and oxidation resistance, and max elongation at all temperatures. Material has been used at temperatures up to 1300 F.

Wall Colmonoy Corp, 19345 John R St, Detroit 3, Mich

Introducing...
the Kodak Contour Projector, Model 14-6, with Measuring Table

- **Makes fixturing easier and setups faster with table cross travel of 3″; vertical travel of 2⅛″. Focusing travel is 1½″.**
- **Provides rapid horizontal measurement to the order of .0002″ for toolroom as well as production use. Simplifies gaging of larger parts—less need to reposition.**
- **Slotted worktable—19¼″ x 8″—permits use of standard fixtures for staging wide variety of parts. Throat clearance is 14¼″. Maximum lens height above table, 4¼″; minimum, 2⅛″.**

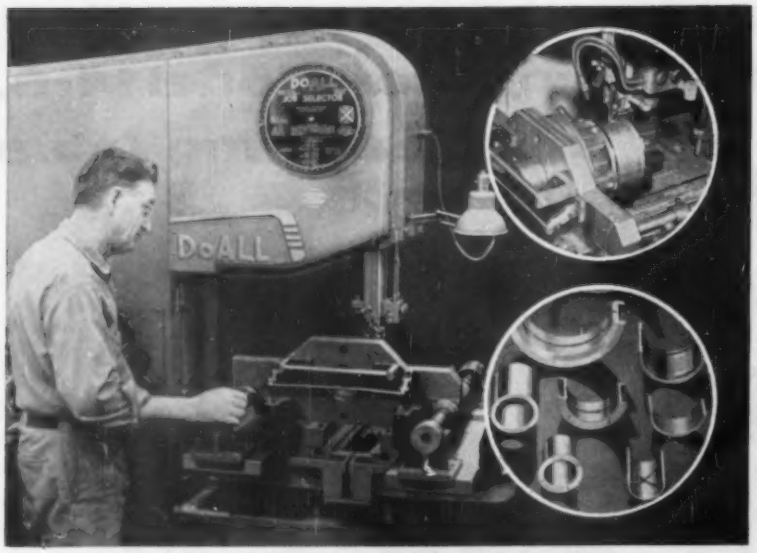
THE Model 14-6 is equipped with the same high-quality, precision optical system as all other Kodak Contour Projectors. Kodak's famed Ektar Projection Lenses and rigidly built lens mounts and housings insure accurate performance year after year. A full 14-inch viewing screen covers a field of 1.4″ at 10× magnification. Coated lenses which increase light transmission—plus a special Fresnel lens back of the screen—give a bright image, permitting you to use the Model 14-6 anywhere in the plant. Accessory projection lenses provide a choice of six magnifications (10×, 20×, 31¼×, 50×, 62½×, and 100×). All lenses are quickly interchangeable, seat positively for precise rated magnification. Air-cooled lamphouse and simple, handy controls assure operator ease and comfort.

Vertical illuminator, surface illuminator, six-lens turret, rotating screen with protractor ring, and a mobile base are available as accessories. For further information about the new Kodak Contour Projector, Model 14-6, write to:

Apparatus and Optical Division

EASTMAN KODAK COMPANY • Rochester 4, N. Y.

Kodak



MANUFACTURING more transportation at minimum cost . . .

How to Keep The Economy Highballing

Each year, every breadwinner has more mouths to feed! Here is why:

Our population expands per year about	1.7%
(and people are living longer and retiring earlier). Our "labor force" (the age group that brings home the pay check) expands only about	1.0%
This difference—of fewer breadwinners every year equals	0.7%

This means constant pressure for bigger pay checks.

The only answer is more and better tools of production. Only then can a man produce more and earn more, without forcing prices up hand in hand with wages.

The machine tool in the picture above illustrates the principle. With it the operator splits bearings for diesel locomotives in half the time

required by the old method. This new machining method enables him to produce more at lower cost per unit. Time savings like this throughout industry, add up to a greater quantity of goods for everyone . . . at reasonable prices. This is the only way the working force can support an increasing number of dependents.

The DoALL machine shown is industry's newest basic machine tool. It will do many jobs in ⅓ to ½ the time required by other machine tools. Cutting is faster, fixturing is simpler and initial investment is lower.

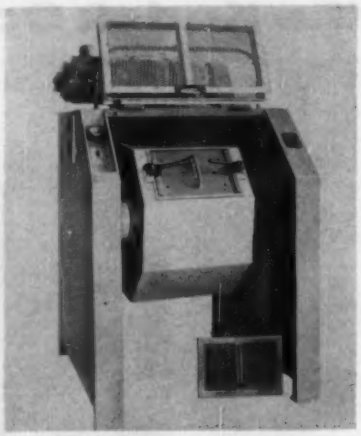
Any manufacturer seeking production savings is invited to see a free demonstration at his own plant.

Reprints of this series on economics available for your employees.

The DoALL Company

Des Plaines, Illinois

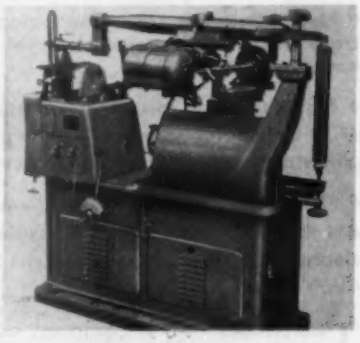
38 Local Sales-Service Stores E-47



FINISHING BARREL, designed for users requiring variable speeds, features a 22 by 33-in. barrel of welded steel plate with capacity of 1200 lb. Available in single- or double-compartment units with or without neoprene linings, barrel operates at 7 to 30 rpm—*Abbott Ball Co, Hartford, Conn*

Abrasive belt cleaner called Hapomit is a rotating steel-wire brush that removes clogging material as hand brake is gradually appplied. A Western European product, brush sells for about $13 and is said to increase useful life of belt by 30%.

Imported by Henley & Co, Inc, 27 Spruce St, New York 38, NY



Automatic Cutter Grinder

Multi-toothed and staggered-tooth milling cutters for climb and conventional milling can be relief milled and form ground on the Jemco automatic machine.

Templet copying attachment increases versatility by making possible the cutting of machine components such as cam segments, rachet sections, tripping mechanisms. Simple alteration allows the same

INVESTIGATE...

...CARBIDE TIPPED CHASERS...FOR GEOMETRIC TOOLS

Whether you are threading stainless or heat treated steels, abrasive materials such as iron castings, malleable iron, brass, bronze, aluminum, or plastics, hard rubber, fibre and the like,.... better look into GEOMETRIC threading tools, and chasers with Carbide Inserts.

These chasers are making impressive records on high production, long run jobs where down time must be held to an absolute minimum. Parts threaded and life between grinds are multiplied over any previous method of generating external or internal screw threads.

Investigate today....write us or call your nearest GEOMETRIC DISTRIBUTOR.

Greenfield Tap and Die Corporation

GEOMETRIC TOOL COMPANY DIVISION

New Haven 15, Connecticut

Photo courtesy of the R. K. LeBlond Machine Tool Company

THE LATHE — *LeBlond 25" Heavy Duty Engine Lathe*

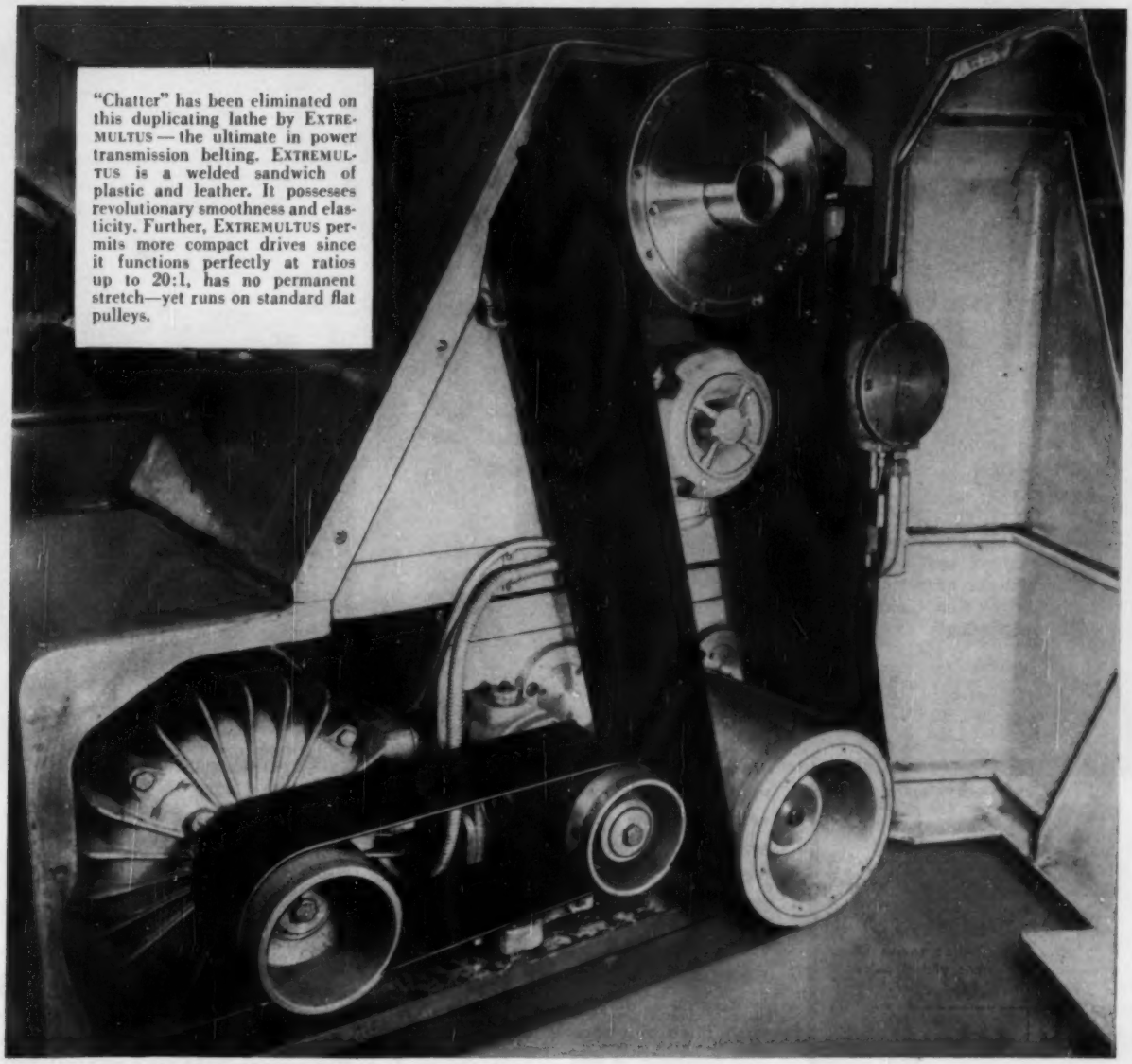
THE OPERATION — *Rough sizing a steel 25" heavy duty spindle forging, using a 1/2" cut*

THE CHUCK — *Horton, of course*

HORTON CHUCK DIVISION
Greenfield Tap and Die Corporation
Windsor Locks, Connecticut

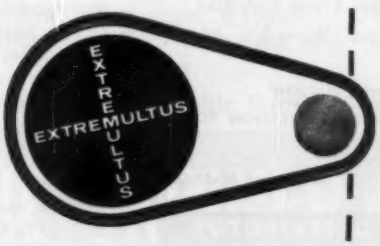
HORTON
Since 1851
CHUCK

Call Your Horton Distributor Now!



"Chatter" has been eliminated on this duplicating lathe by EXTREMULTUS — the ultimate in power transmission belting. EXTREMULTUS is a welded sandwich of plastic and leather. It possesses revolutionary smoothness and elasticity. Further, EXTREMULTUS permits more compact drives since it functions perfectly at ratios up to 20:1, has no permanent stretch—yet runs on standard flat pulleys.

NO BELT SLIP, NO TENSION LOSS, NO VIBRATION on this DUPLICATING LATHE



EXTREMULTUS, INC.
405 Lexington Ave., New York 17, N.Y.

Please rush full information on EXTREMULTUS for use on .....

Name .....

Title .....

Company .....

Street .....

City ..... State .....

LUFKIN

RADIUS GAGES Now Available for 1-1/16" to 2" RADII

Convenience and Adaptability Have Made Lufkin the First Choice in Radius Gages

1. Determines radius of inside corner and if sides are 90°.

2. Determines radius of outside corner and if sides are 90°.

3. Determines convex radius near projection that prevents use of gage as in views 2 and 5.

4. Checks any concave radius that is ⅓ or less of circle.

5. Checks ½ of a circumference.

This style radius gage, preferred by toolmakers, diemakers, patternmakers, inspectors, layout men and others, is now available in a complete range of sizes up to 2".

With a design pioneered and developed by Lufkin, each gage is a separate unit with five different gaging applications for use on both concave and convex radii. The gaging surfaces have smooth, accurately machined edges, and the sides of the blade have a polished, natural metal finish.

Available in sets as listed below or by individual gage. Sets are packaged in durable folding cases of heavy red vinyl, fitted with pockets for each edge.

No. 77A	16 gages 1/32 to 17/64 by 64ths
No. 77AX	17 gages 1/64 to 17/64 by 64ths and No. 20 Holder
No. 77B	8 gages 9/32 to ½ by 32nds
No. 77C	24 gages (Sets 77A and 77B Combined)
No. 77CX	25 gages (Sets 77AX and 77B Combined)
No. 77D	16 gages 1/32 to ½ by 32nds
No. 77E	8 gages 9/16 to 1 by 16ths
No. 77F	8 gages 1⅛ to 2 by 8ths
No. 77G	16 gages 1 1/16 to 2 by 16ths

BETTER MEASURE WITH LUFKIN
TAPES • RULES • PRECISION TOOLS

473

THE LUFKIN RULE CO., Saginaw, Michigan

IT PAYS TO USE YOUR INDUSTRIAL DISTRIBUTOR
. . . He can simplify your purchasing

templet to produce cutter teeth of the same form in a wide range of sizes. Attachments are available for cutting back every second tooth, or every second and third tooth.

Jersey Manufacturing Co, 407 Livingston St, NJ

WET-HONE MACHINE, which accommodates abrasives from 30 to 500 mesh, performs cleaning, deburring, honing, and polishing operations. Installation consists of attaching 1-in. air line and ½-in. water line, plus electrical connection. Model WH-4836 (illustrated) is 84 in. high, 48 in. wide, and 52 in. deep. Variance of operation is accomplished by reducing or increasing pressure on regulator valve and changing abrasive to suit—*Clementina Ltd, 2277 Jerrold Ave, San Francisco 24, Calif*

Drum connections are now available for Torit 219-FB-55 dust collectors. These connectors fit any standard 55-gal drum, and an air-tight seal on drum cover eliminates need for clamps. Drums reportedly can be changed in 30 sec.

Torit Mfg Co, Dept KP, 287 Walnut St, St Paul 2, Minn

Industrial safety glasses, Type S-7, have square-shaped safety frames and can be fitted with Optilite (plastic) or hardened-glass lenses. Standard shades of green and rose lenses are also available. Frames come in two colors: bronze or crystal pink.

U S Safety Service Co, 1215 McGee St, Kansas City 6, Mo

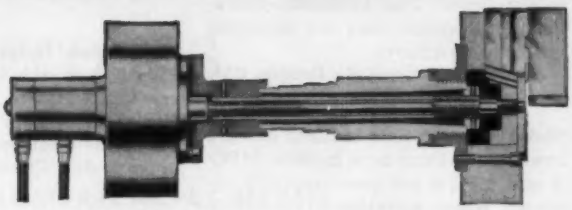
Plug-in static control unit, an addition to G E low-power static switching system (*AM*—Dec 31 '56, p 122),

Skinner Power Chucks will chalk up immediate savings on your production machines!

Cost-per-piece savings add up to a really important figure for production boring done on this Skinner-equipped Potter & Johnston 3-U Speed-flex automatic chucker. You can give your plant the same kind of savings, too.

Look at that Skinner Power Chuck. It grips and releases instantly — compressed air does the hard work, and does it fast. You can see how much longer it would take to chuck these pieces by hand — time that pushes up costs. Elimination of hand wrenching cuts fatigue way down, too — operators like that.

You'll put your plant in a much better profit position when you equip your production machines with Skinner Power Chucks, because you'll greatly reduce your most important cost factor: overall machining time. Write for Catalog 68P, with complete specifications, applications, and installation instructions. Write Dept. 105.



For small lathes, too!

On small lathes, like South Bend, Hardinge, Sheldon, Logan, or Atlas, used on production runs, the Skinner "Junior" Power Chucking Unit will cut costs by saving *time*. Ask for special Bulletin JP67.

Simple, dependable operation.

Skinner's proved-in-service wedge principle guarantees positive, trouble-free operation. Jaws are closed or opened instantly by an actuating wedge, operated by a double-acting air cylinder.

Skinner Power Chucks are available through leading Industrial Distributors everywhere.

SKINNER CHUCKS

THE SKINNER CHUCK COMPANY

ESTABLISHED 1887

NEW BRITAIN, CONNECTICUT

brings to eight the number of individual elements available. Unit provides protective functions by means of three electrically isolated control windings on a magnetic amplifier unit. Device is equipped with a monitor light that indicates whether it is in operation.

General Electric Co, Schenectady 5, NY

Oxide chip breaker designed for use with oxide cutting tools provides the resistance to abrasion and cratering necessary to maintain uniform chip control. Because of low coefficient of friction and low thermal conductivity, friction heat is practically negligible. Chip breaker can be used with any toolholder that will accommodate its design.

Diamonite Products Mfg Co, Canton, Ohio

Fractional-hp gearmotors with high starting torque have a shaft-output speed of 144 rpm and if desired can be made instantly reversible. Gearmotors can also be equipped with a magnetic-disk brake for instant stopping and with a friction clutch as a safety factor. For automatic-operation applications, they are equipped with limit switches.

Brown-Brockmeyer Co, Dayton, Ohio

Metal parts cleaners in Circo line are available in three new models: MPC-3 and MPC-4 are pneumatically operated, power-agitation cleaners that are fully automatic and can be used cold or with steam, gas, or electric; MPC-5 power-agitation cleaner is motor operated and is also available for cold, steam, or electric heat operation.

Circo Equipment Co, 51 Terminal Ave, Clark, NJ

"I understand you use idlers on your belt grinders."

Boron-carbide gage points, trademarked Norbide, are available for standard and special gages. Said to be cheaper than sapphire or tungsten carbide points, devices reportedly won't pick up dust or become charged, will remain smooth and polished during use, and will not scratch work on any metal.

Robert Marks Co, 47 Goddard St, Providence, RI

Coolant, Royal Flush 306F, is said to step up tool life in cutting of metals, especially on new, harder alloys such as 19-9 DL stainless and 17-7 PHS stainless. A water-borne catalyst is electro-magnetically attracted to tool by static charge produced by tool as it parts metal or substance being machined. Catalyst stops pick-up on the tool, keeping it cool. Material leaves no film, and is non-toxic.

Folden Chemical Ltd, 9015 Wilshire Blvd, Los Angeles, Calif

Conversion factors wall chart includes such data as inches to centimeters, watts to hp, cubic feet to liters, microns to meters.

Precision Equipment Co, 3716 N Milwaukee Ave, Chicago 41, Ill

Mist coolant system, designated Trico-Mist, has dual-valve control permitting separate adjustment of air supply and coolant for variation of coolant mixture from a very fine invisible mist to a maximum discharge. System can be operated on 25 to 125-lb air pressure. When coolant valve is closed, compressed air only can be discharged for blowing chips away. Bulletin 37-A.

Trico Fuse Mfg Co, 2948 N 5th St, Milwaukee 12, Wis

Lubricant, Dri-Film Perma-Glide, for moving parts, is available in 6-oz aerosol spray container. Said to be effective at −100 and +750 F, product is priced at 98¢ per can.

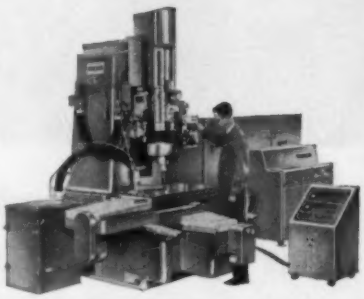
Flamemaster Chemicals, Inc, 3813 Hoke Ave, Culver City, Calif

Semi-automatic 4-way valve, designed for die-casting industry, provides leak-free service with water,

PRATT & WHITNEY NUMERICAL CONTROL APPLICATIONS

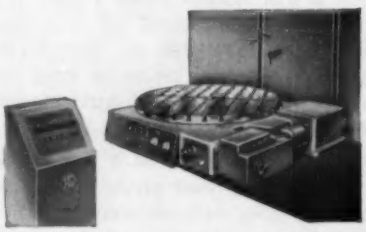
ELECTROLIMIT JIG BORER

Equipped with Numerical Control, the P&W No. 2E Jig Borer is equally suitable for toolroom and precision production applications. Settings accurate to .0001" are made automatically from data supplied by a punched tape or an operator's keyboard.



VERTICAL PRECISION HOLE GRINDER

Table and carriage are similar in design to the No. 2E Jig Borer and the same ultra-precision Electrolimit Measuring System is employed. Column, however, is equipped with interchangeable, turbine-driven grinding heads for spindle speeds to 100,000 rpm.



PRECISION ROTARY TABLES

These Pratt & Whitney Rotary Tables are the ultimate in precision and convenience for circular spacing, graduating and angular positioning. Settings accurate to 5 seconds of arc (2 seconds for repetitive settings) are made automatically from data supplied by punched tape or operator's keyboard.

PRATT & WHITNEY

TO "TENTHS" IN SECONDS

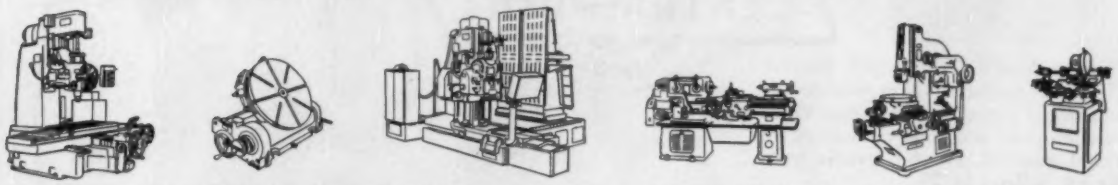
. . . *and no mistakes!*

WITH NEW PRATT & WHITNEY NUMERICAL CONTROL

Operating under Numerical Control, this P&W Precision Hole Grinder is positioned and re-positioned — accurate to .0001" — in an average of only 14 seconds! And since settings are controlled by a punched tape, the chance of work spoilage through operator error in reading blueprint data or setting dials is eliminated. The operator is free to concentrate his attention on work quality.

Applied to Pratt & Whitney Jig Borers, Precision Hole Grinders, Rotary Tables and special machines, Numerical Control not only speeds up toolroom operations, but also makes the high precision of these machines available for efficient short- or long-run production work. In this type work, time savings up to 40% over manual operation are realized. Compare the performance of your present manually-controlled machines with the new standards of speed, accuracy and economy being established by numerically-controlled P&W equipment. If they don't measure up, you are missing important opportunities for improved work quality, larger savings and greater profits.

Write now for complete information.
Pratt & Whitney Company, Incorporated,
11 Charter Oak Boulevard, West Hartford, Conn.

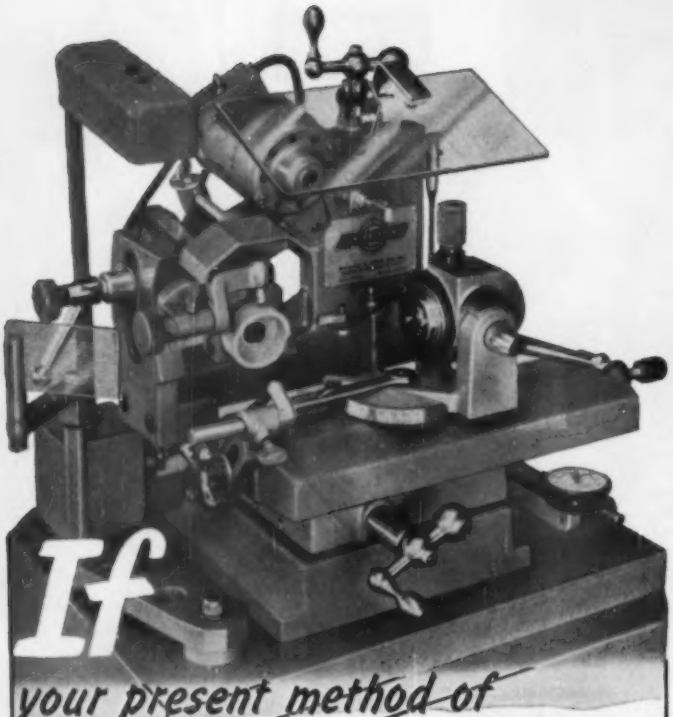


JIG BORERS . . . ROTARY TABLES . . . KELLER MACHINES . . . LATHES . . . VERTICAL SHAPERS . . . CUTTER AND RADIUS GRINDERS

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS



If your present method of sharpening small cutters is

..SLOW, INACCURATE, COSTLY—

GIVING POOR CUTTING EDGE AND FINISH—

CAUSING RUN-OUT IN SHARPENED CUTTERS—

CONSUMING TOO MUCH TIME CHANGING SETUPS—

TYING UP A LARGE EXPENSIVE MACHINE FOR SMALL WORK—

YOU NEED A END MILL **CENTRA·POINT** GRINDER ®

Centra·Point's 12 advanced features *really can* overcome all these problems by mechanically performing functions which are troublesome and time-consuming on standard grinders. For full details write today for Bulletin M-55.

Manufactured in Boston

WILLIAM H. FIELD CO., INC.

SINCE 1880

326 Dorchester Ave., Boston 27, Mass.

NEW SHOP EQUIPMENT

glycol, or oil-base hydraulic fluids. Activated by integral double-acting cylinder controlled by a single or double solenoid pilot-operated valve, the E-400-X series comes in 1, 1½, and 2-in.-NPT sizes, for pressures up to 3000 psi. 60 to 125-psi air actuates valve.

Sinclair-Collins Valve Co, Akron, Ohio

Aluminum Cleaner 164 is specially compounded to clean without foaming in agitated tanks. It removes identification inks, grease, and heavy soils.

Oakite Products, 124 Rector St, New York 6, NY

Machine vise, Model P-3 heavy-duty type, has been added to company's Low-Boy line. Device has 8½-in. jaw width, 6¾-in.-max jaw opening with jaw plates in place, and weighs 194 lb. It is equipped with coolant run-off trough, and has a solid bottom slide.

Universal Vise & Tool Co, Parma, Mich

Pressure flow lubricator will deliver lubricating oil or other liquids under pressure, in measured quantities, to high or otherwise inaccessible places. Device is offered as single unit or in multiples of 15, depending on number of feeds required. Designed for 125-psi max working pressure, each lubricator making up a multiple unit

"You mustn't expect miracles! After all, I've only been here five years!"

SIP

Guaranteed Accuracy

More and more manufacturers apply SIP *Guaranteed* Accuracy to define, establish and maintain high precision in production and measurement to improve quality-of-output and economy-of-operation.

NORTHERN ORDNANCE INCORPORATED

TEMCO AIRCRAFT CORPORATION

American Optical

Rheem AVIATION PLANT

National

Avey

SPERRY

IBM

CANADAIR — AIRCRAFT MANUFACTURERS —

Thompson Products, Inc.

MOTCH & MERRYWEATHER

Ford

LOCKHEED

Hamilton Watches

RENDA ENGINES

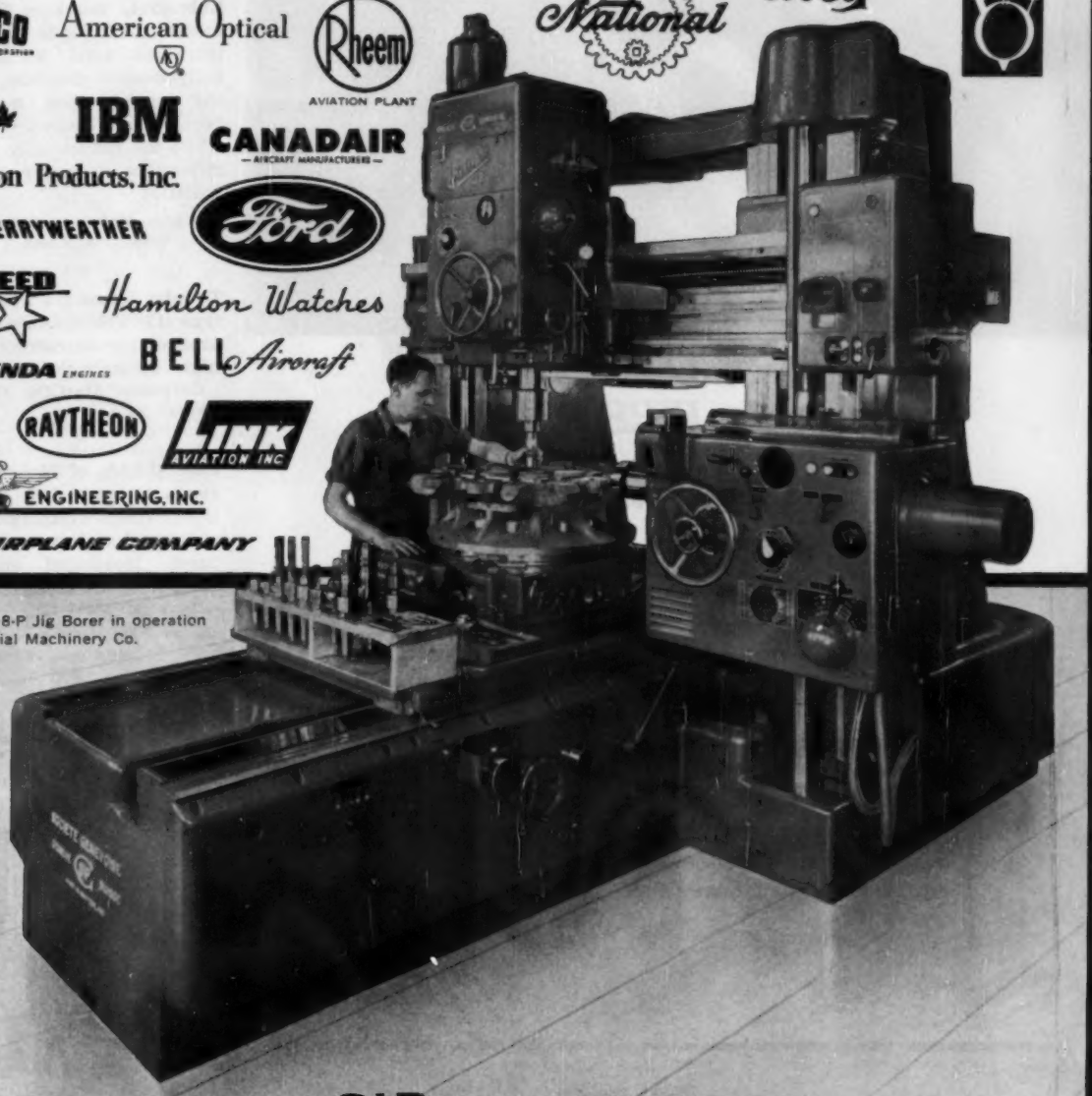
BELL Aircraft

RAYTHEON

LINK AVIATION INC

Merz ENGINEERING, INC.

BOEING AIRPLANE COMPANY

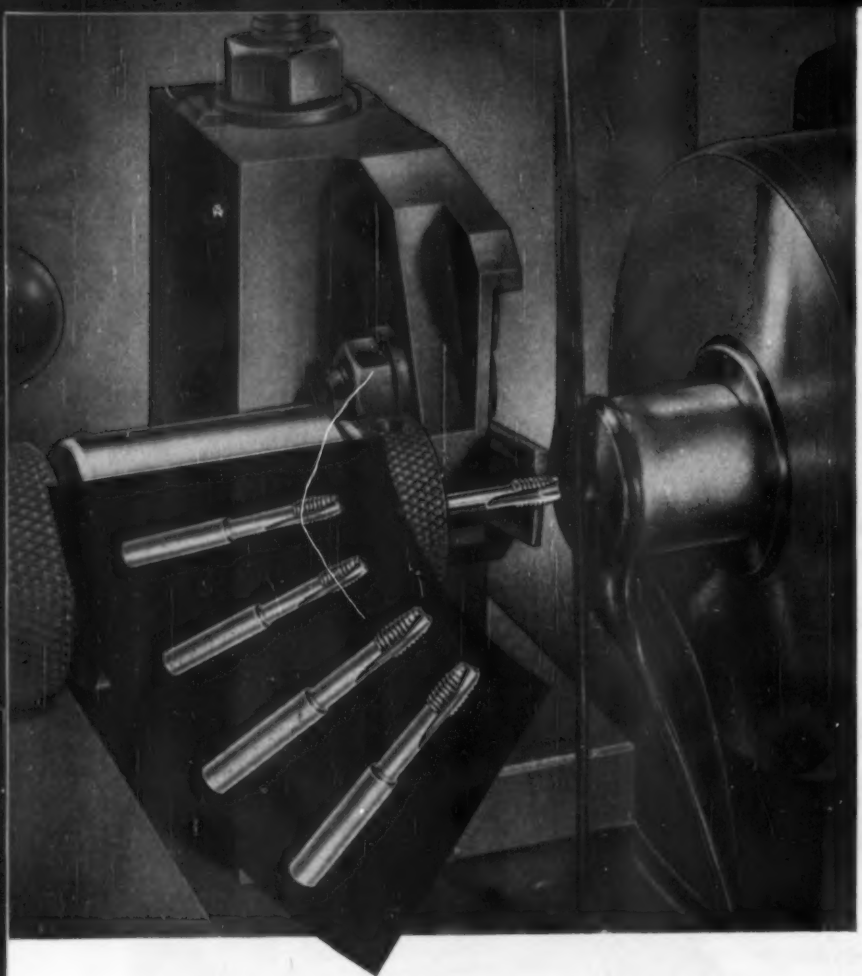


SIP HYDROPTIC 8-P Jig Borer in operation at Hartford Special Machinery Co.

AMERICAN SIP CORPORATION

HIGH PRECISION MACHINE TOOLS & MEASURING EQUIPMENT

100 EAST 42nd STREET, NEW YORK 17, N. Y.



Here, for the FIRST Time . . .

IS A TAP SPECIFICALLY FOR SCREW MACHINES.

This new high speed steel, ground thread tap with its short thread length, spiral point, and specially heat-treated necked shank cuts cleaner threads, has longer life, reduces bellmouth condition and tap breakage . . . and pays big dividends in improved work quality, increased output, and lower tooling costs! Tests prove that performance is excellent on practically all machinable metals. Plug and bottoming types in machine screw sizes No. 2 to No. 10 . . . available *now* from stock at the P&W Branch Office near you. Write for complete information. *Pratt & Whitney Company, Inc., 11 Charter Oak Boulevard, West Hartford, Connecticut.*

. . . THREAD ROLLING DIES • DUOCORE DIES • TAPS • THREAD MILLING CUTTERS • REAMERS . . .

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

NEW SHOP EQUIPMENT

is capable of feeding fluid varying from several drops to two pints per min by adjustment of needle valves.

Wm W Nugent & Co, Inc, 3440 Cleveland Ave, Skokie, Ill

Tap, called elektra-Lube, is processed so that a thin ductile deposit is imparted which acts as a permanent super-lubricant. Under working pressures, deposit reportedly imbeds itself into the microscopic pores of the ground tap, resulting in a smooth, burnished surface, freer cutting, and reduction in torque.

Sossner Tap & Tool Corp, Lynbrook, NY

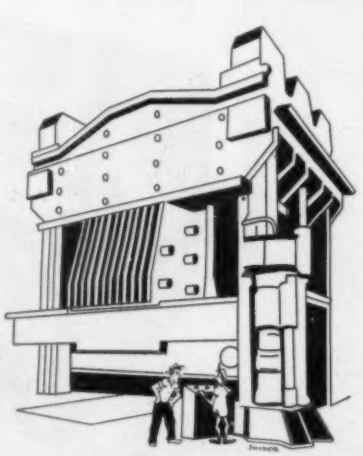
Lubricant, Molykote GX, is refinement of Molykote G and has an increased total surface area of molybdenum disulfide. By decreasing particle size more MoS_2 is brought into contact with the metal, while the reduction in solid content minimizes excessive surface accumulation.

Alpha Molykote Corp, 65 Harvard Ave, Stamford, Conn

Tubular forms are now available in type 17-7PH stainless. Material is precipitation hardening type, and has high strength-to-weight ratio.

Carpenter Steel Co, Alloy Tube Div, Union, NJ

Face shields of Musketeer line are available with four types of face shield visors which fasten to front of wide spark deflector, pivoted to headband. Headband and adjustable cross-strap are molded nylon. Shields



"What do I care about neatness? Get your pants out of that press and put them on!"

available are: fiber visor with welding lens, metal-bound plastic visor in various depths, wider all-plastic visor, and a 24-mesh wire screen visor.

Jackson Products, Air Reduction Sales Co, Warren, Mich

Steam cleaning unit called Steamerette is an injector unit that uses existing steam supplies for paint stripping, phosphating, or sanitizing. It operates in range of 40 to 140 psi steam, and requires adjustment of only one valve for operation. Unit has no pumps or motors, is easily attached to any steam line, and has a built-in pressure gage. Bulletin available.

Turco Products, Inc, 6135 S Central Ave, Los Angeles 1, Calif

Headed pins, for use in metal stamping tools and in plastic mold manufacturing, are available in a range of sizes from 0.020 through 0.1875 by 0.001 increments. Royal pins are hone finished, have a hardness of R_c 58-60, with heads left soft. Prices range from $12 to $19 per box of 100 pins.

Durant Tool Supply Co, 1-15 Thurbers Ave, Providence, RI

Safety glasses, 700 Series, retain company's square-shape design but have plastic frames. Acetate butyrate frames give strength and flexibility without weight. Side shielded models are also available.

Sellstrom Mfg Co, Palatine, Ill

Large-bore backstop clutches, available in max bore sizes from 6 to 12

(Continued on page 220)

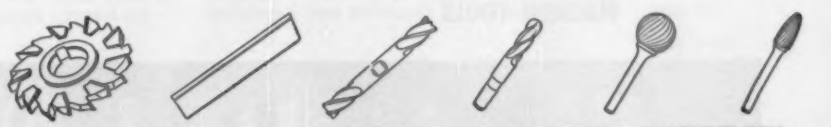
"You can come in for dictation now."

210,000 HOLES . . .

AND STILL RUNNING!

120,000 pieces before the first grind . . . 90,000 after grinding . . . and still producing accurately threaded holes! These are the actual performance figures reported by a satisfied user of P&W Taps. Performance like this is possible, because P&W Taps are *always* accurate, always concentric with shanks, threads, OD's and chamfers . . . *all* ground *on centers.*

When you buy taps, *you're really buying the number of finished workpieces they'll produce.* That's why Pratt & Whitney Taps and other Cutting Tools are your best buy. Complete lines available from stock at the P&W Branch Office near you. Write for full information. *Pratt & Whitney Company, Inc., 11 Charter Oak Boulevard, West Hartford, Connecticut.*



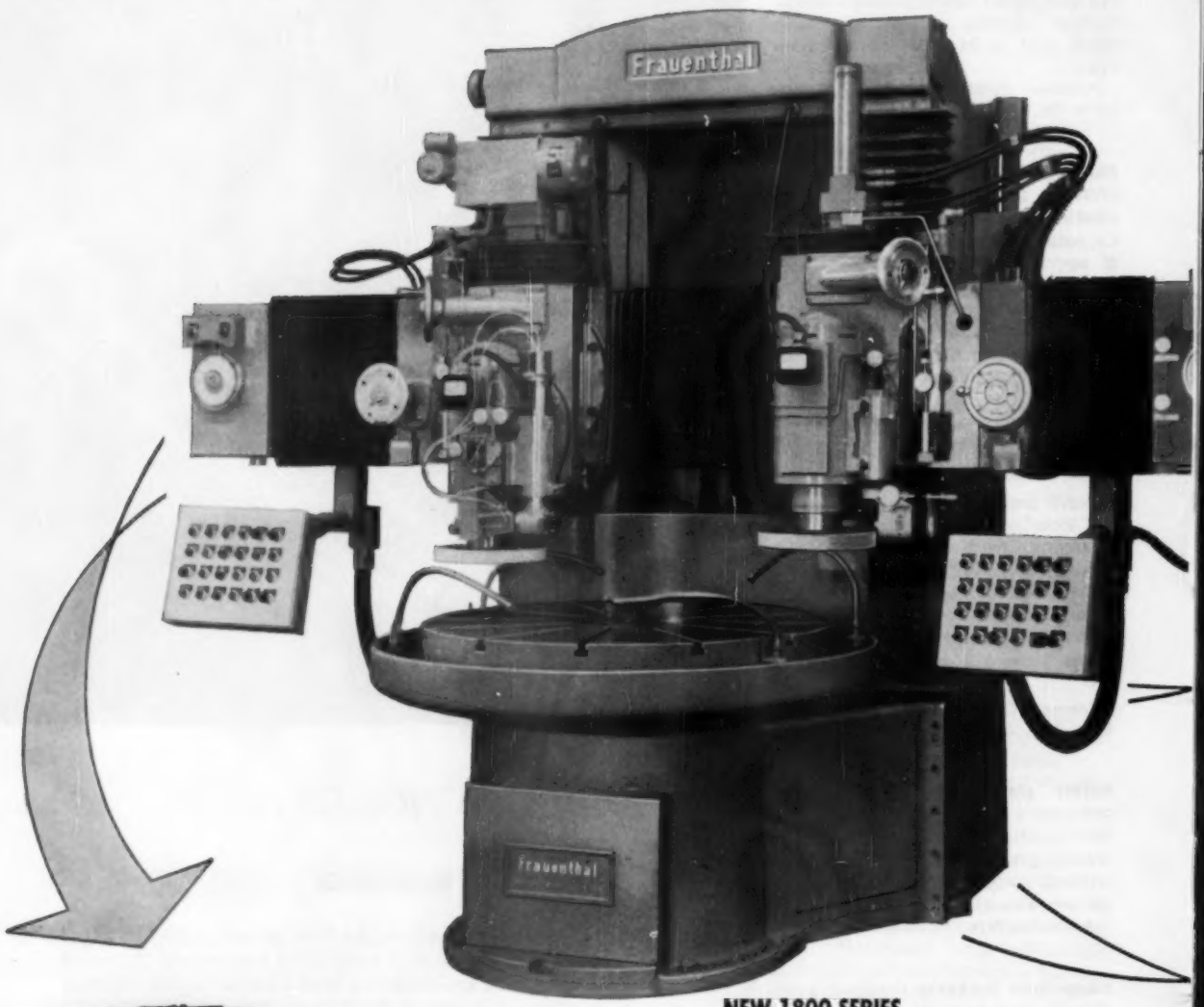
. . . MILLING CUTTERS • CUT-OFF BLADES • END MILLS • KELLER CUTTERS • KELLERFLEX BURS . . .

PRATT & WHITNEY

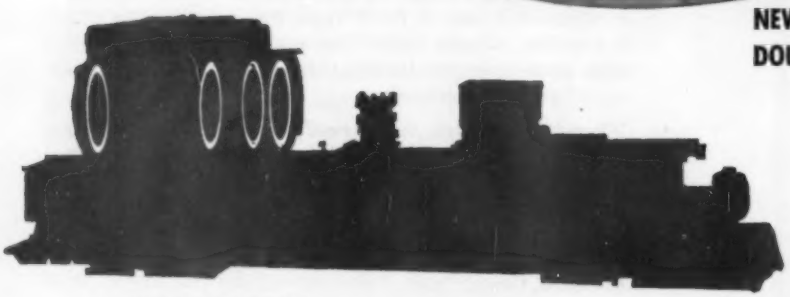
FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

PRECISION-GROUND



NEW 1800 SERIES
DOUBLE HEAD GRINDER



MACHINE TOOLS

Free Catalog!

For complete details on Frauenthal 1800 Series Double Head Grinders, write for catalog.

Frauenthal Division

COMPONENTS . . .

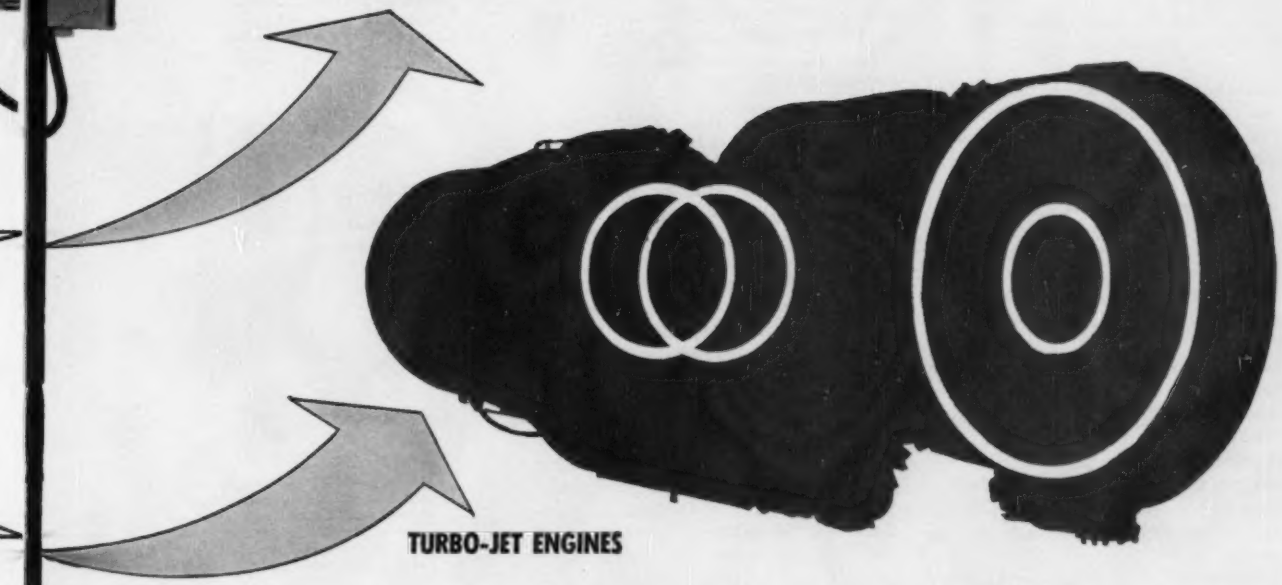
ORDNANCE

WHATEVER YOUR FIELD OF INDUSTRY — With Frauenthal precision machines, you're able to grind diameters and related surfaces without changing setup of the workpiece and obtain accuracies within .000200". This assures consistently uniform precision in concentricity, parallelism and roundness.

The accuracy and versatility of Frauenthal equipment is unequalled in the machine tool field. Difficult work-pieces — those impossible to handle on conventional horizontal grinding equipment — are handled with comparative ease on these unusual machines.

Four different series of machines are available affording table sizes up to 140". The 1800 Series Double Head Precision grinder, illustrated at left, is now available with a maximum swing of 72" and various table sizes to suit customer specifications.

For complete details, contact Frauenthal of Muskegon, Michigan.



TURBO-JET ENGINES

MACHINE TOOLS — Modern day machine tools are required to produce piece parts to greater accuracy than ever before. Therefore, machine tool components must be more precise to the nth degree. With Frauenthal grinders you can grind collets, chucks, spindle sleeves and similar components under simulated assembly conditions to assure concentricity, parallelism and roundness. Eliminate costly and time consuming hand scraping and grind plated parts prior to and after plating for increased wearability.

TURBO-JET ENGINES — Diffuser cases, rotors, compressor discs, vanes, etc., are components of jet engines ground on Frauenthal equipment. Thin section parts, which are unstable due to their design, are ground on the horizontal rotary table of the 1800 and 3100 Series machines. The compound and spindle angle setting features permit the grinding of surfaces normally inaccessible on conventional equipment.

ORDNANCE — Large bearings and housing components for ordnance applications are ground on the 1800 and 2200 Series grinders. Applications vary from aircraft gun turret bearings to the large turret bearings required for tanks, motorized gun carriages, radar and naval gun mounts.

No. F-257

THE KAYDON ENGINEERING CORP.

MUSKEGON, MICHIGAN

in., with torque capacities from 18,500 to 136,500 ft-lb, replace company's previous models. Models FS-1100, 1150, 1200, 1250, 1300, and 1400 have individually energized sprags, ball-bearing construction, mechanical seals, and grease lubrication.

Formsprag Co, Application Engineering Dept, 23601 Hoover Rd, Van Dyke, Mich

Wall-mounted pyrometer, Type R-4200, combines convenience of a portable unit with protection of a wall-mounted unit. Device is available with flexible arm and choice of ten thermocouples in standard ranges from 0-300 to 0-2000 F. Centigrade equivalents and special ranges including below-zero temperatures, are also offered.

Illinois Testing Laboratories, Inc, 420 N LaSalle St, Chicago 10, Ill

Aluminum casting alloy, called 42B, has been developed for producing intricate, completely formed aircraft and missile parts in a single operation. Alloy, said to be 40% stronger than the best previous alloy, reportedly cuts time required to produce castings. Company reports that other uses are being explored.

North American Aviation, Inc, International Airport, Los Angeles 45, Calif

Tap bushings that accommodate 13 popular tap sizes reportedly reduce breakage and make possible close-tolerance tapping on lathes, millers, tapping machines, and drillpresses. No special drivers are needed so long as tool has a 1¼-in. hole. Bushing socket engages square of tap shank.

Beaver Tool & Engineering Corp, Royal Oak, Mich

"I missed the ferry, boss."

Identification nameplates for control panel elements, motors, limit switches, terminal boxes, and other equipment mounted on machinery are available in fiber or aluminum. Special adhesive on back of the ⅜ x 1-in. plates forms strong, permanent, heat-resisting bond when applied to any surface. Standard JIC markings or special markings are available.

ECP Corp, 6808 Wade Park Ave, Cleveland 3, Ohio

Protective coating, M-241, a sprayed and baked material, is claimed to impart a mirror-like brilliance when applied to vacuum metallized metals. Hardness of coating is between 7H and 9H pencil hardness, abrasion resistance is said to be 48% better than average lacquer-type coating, and humidity resistance is 1500 hr at 110 F, 100% relative humidity.

Logo Inc, 12933 S Stony Island Ave, Chicago 33, Ill

Oil cooler for Pratt & Whitney vertical hole grinder consists of two cast-aluminum water coolers. Oil is circulated through coolers to maintain room temperature conditions throughout the machine's hydraulic system. Temperature difference between hydraulic oil and grinder is kept at ± 1 F. Cooling unit is contained in separate cabinet at rear of machine.

Heat-X, Brewster, NY

Lubricating pumps in Model OB line are designed to handle lubricating, hydraulic, and light fuel oils at pressures to 300 psi and speeds to 1800 rpm. Pumping capacity is 24, 30, or 39 gal per hr with either right or left rotation. Two inlet and two outlet ports permit connection on either side of the body.

Sundstrand Machine Tool Co, Hydraulic Div, 2210 Harrison Ave, Rockford, Ill

Warner electric clutch and brake, now available as extra equipment on all Nebel lathes, has many features including faster braking than with cone-type friction brake, push-button control, adjustable acceleration and deceleration rates, low maintenance.

Nebel Machine Tool Corp, Cincinnati 25, Ohio

Fork lift attachment, consisting of multiple forks, side-shifter, and push-off device, is designed for use

(Advertisement)

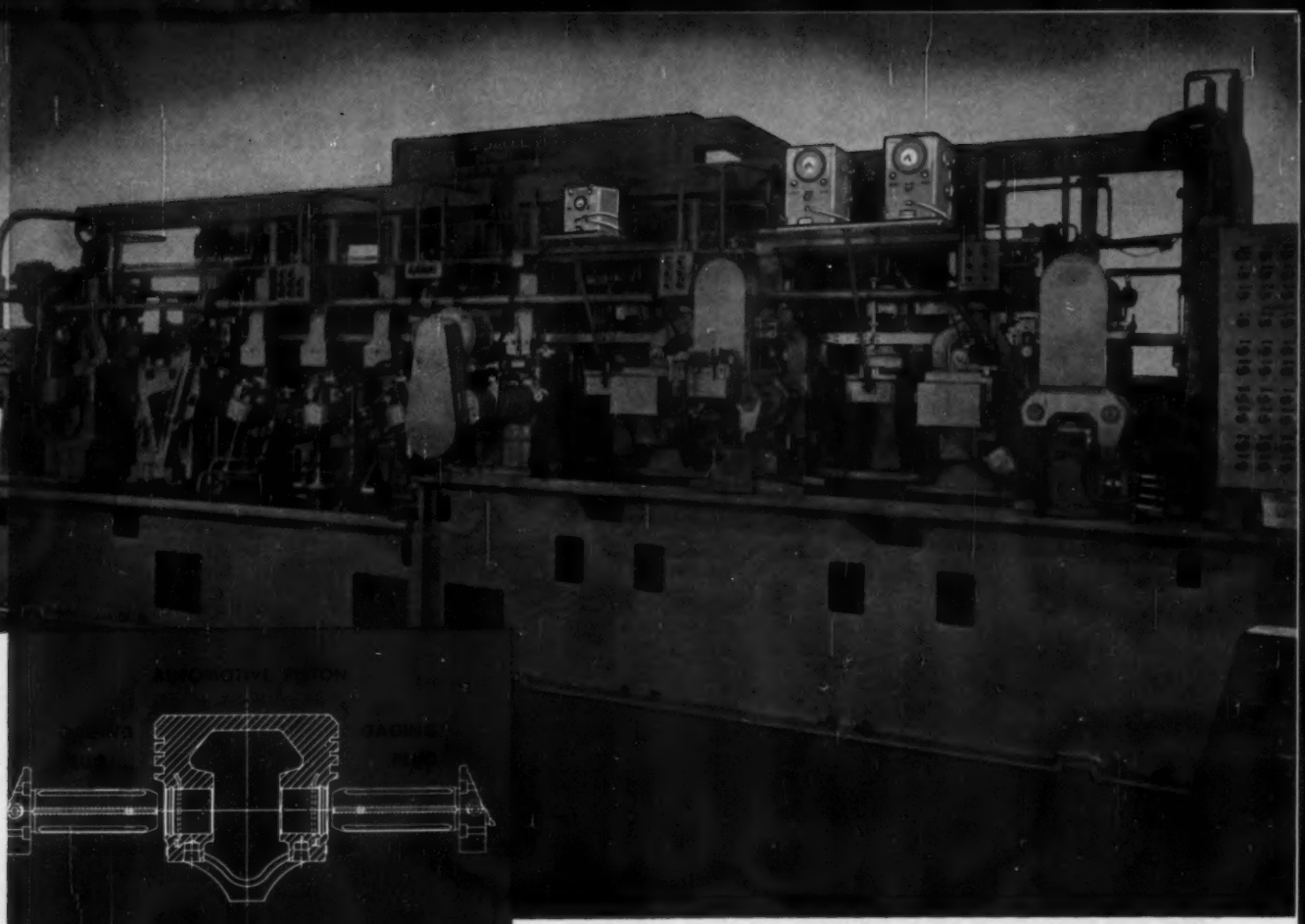
BUILD A GAGE INSTALLATION TO SUIT YOUR NEEDS . . .

with these packaged, on-the-shelf P&W Air-O-Limit Light Signal Units. Can be used to signal operator or to provide feed-back impulse for fully automatic process control.

BASIC 2-LIMIT UNIT . . . indicates high and low tolerances. Suitable for sorting and other "yes-or-no" control applications.

3-LIMIT UNIT . . . especially suited for grinding and similar operations. Indicates or automatically controls such conditions as: "Fast Feed," "Slow Feed," and "Spark-Out."

4-LIMIT UNIT . . . similar to 3-Limit Unit, but provides greater control scope. Indicates or controls such conditions as: "Approach High Limit," "High Limit," "Approach Low Limit" and "Low Limit."



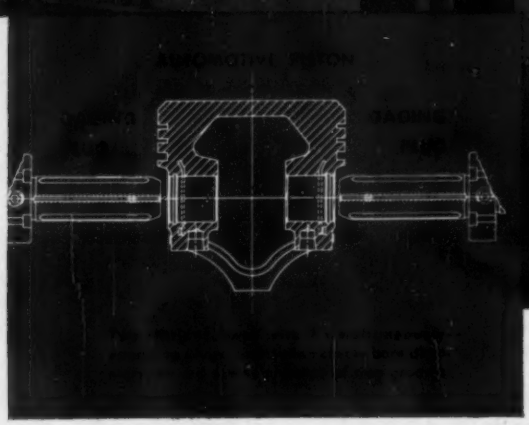


PHOTO COURTESY OF LASALLE TOOL, INC., DETROIT, MICHIGAN

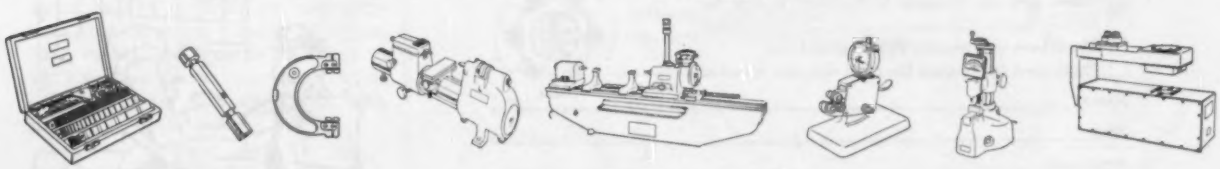
Help Yourself to Increased Output

WITH PRATT & WHITNEY STANDARD, ON-THE-SHELF GAGE CONTROL UNITS

INCREASED OUTPUT RATES, INSURED ACCURACY, REDUCED REJECT LOSSES . . . are the benefits you get with On-Machine Automatic or Automation Gaging! And now, these standard P&W Packaged Units . . . with appropriate tooling . . . can provide an installation tailored to your needs *without* the expense or delays required to engineer and construct special controls.

For example, these P&W Packaged Units made it easy to provide automatic on-machine gaging for this special, high-speed automotive piston machine produced by LaSalle Tool, Inc. Two P&W Air-O-Limit Carbide Gage Plugs are arranged to check the ID of both wrist pin bores on the pistons automatically. Lights on the P&W Control Units signal the operator if tolerances are exceeded. A second set of gage plugs similarly checks bores for the presence of snap ring grooves. If desired, control units can be arranged to shut down the machine automatically when an imperfect part is detected. Whatever *your* requirements, P&W can supply gaging equipment exactly right for the job.

For complete information, write to Pratt & Whitney Company, Incorporated, 11 Charter Oak Boulevard, West Hartford, Connecticut.



GAGE BLOCKS . . . CONVENTIONAL GAGES . . . SUPERMICROMETERS . . . STANDARD MEASURING MACHINES . . . COMPARATORS . . . AUTOMATION AND CONTINUOUS GAGES

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

Why NEW "150" HYDROHONER Is Economical . . . Compact . . . Standardized

Basic Micromatic "150" Machine, suitable for both internal and external Microhoning.

Now, even manufacturers with limited capital can afford Microhoning . . . with all its benefits including efficient stock removal, accurate geometry and controlled surface finish. The new Micromatic "150" Hydrohoner is the answer!

Because it is standardized and produced in quantity, this quality machine is economical. (Special engineering is limited to tooling and fixturing.) The design and quality of the "150" assures performance equal to more expensive honing machines. It has a 12″ stroke and Microhones diameters up to 1½″ . . . yet requires just 34″ x 52″ of floor space.

The Micromatic "150" is ideal for the manufacturer with limited capital, short production runs or a need for standby equipment. Immediate delivery from stock on basic machines.

The principles and application of Microhoning are explained in a 30-minute, 16mm, sound movie, "Progress in Precision"... available at your request.

☐ Please send me "Progress in Precision" in time for showing on _____(date).
☐ Please have a Micromatic Field Engineer call.
☐ Please send Microhoning literature and case histories.

NAME _____
TITLE _____
COMPANY _____
STREET _____
CITY _____ ZONE _____ STATE _____ E

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

with company's Model E trucks and permits handling of normally palletized goods without the aid of pallets.

Lewis-Shepard Products, Inc, Dept R-5, 125 Walnut St, Watertown 72, Mass

Plastisol finishes, for use on all types of manufactured metal goods, machinery, and castings, are available in two series: Flintlok and Tufkote. Flintlok sprays achieve a 95 Durometer (C scale) and will not scratch, chip, crack or peel. Tufkote sprays provide a thicker, cushiony coat in a variety of textures. Finishes are available in complete range of colors. Test samples will be supplied at cost. Bulletin available.

Auburn Button Works, Inc, Chemical Div, Auburn, NY

Collet chuck, Model C, is 3-in. chuck made for American standard 8-in. flange-type spindles and designed for powerful gripping on jobs requiring 20 hp or more. One stroke of operating sleeve takes care of 0.050-in. automatic adjustability plus an extra 0.025-in. opening at the open position for stock removal. Chuck can be operated by hand lever, air or hydraulic cylinder.

Hall Mfg Co, 622 Tularosa Drive, Los Angeles 26, Calif

Flexible tool shaft is said to make ideal, lightweight, portable production tool for drilling, grinding, sanding, or buffing. Model 40 tool shaft consists of ⅜-in.-dia music core that rotates inside rubber-covered casing, and is furnished with ball-bearing motor connection and ball-bearing

"Doggone . . . and here all the time I thought that decimal point was a fly speck."

handpiece with a removable wheel arbor having 1/2-20 thread. It will transmit up to ½ hp at speeds to 6900 rpm.

Stow Mfg Co, 29 Shear St, Binghamton, NY

Jaw clamps secure workpieces to machine tools. One adjusting screw in each clamp provides all the clamping force necessary to position and hold the workpiece. When screw is turned, jaw travels in and down, forcing workpiece against opposite clamp, and downward against face plate or table. Capacities range from 2½-ton to 12-ton down pressure.

J & S Tool Co, Inc, 87 Dorsa Ave, Livingston, NJ

Safety glasses, for use in semi-hazardous operations and for protection of plant visitors, have either clear or green lenses molded of 0.060-in.-thick impact-resistant plastic. Glasses may be worn comfortably over prescription glasses. Each pair is furnished with case. Cost $6.60 a dozen.

General Scientific Equipment Co, 7516 Limekiln Tpke, Philadelphia 50, Penna

Mast for lift trucks of company's Truck-Man line is called Multi-Lift Mast and gives trucks a lower silhouette while maintaining equal or higher lift. Truck having a 144-in. lift has a lowered height of only 72 in. This is about 20 in. lower than with conventional masts. Forks travel 3 in. for each 2-in. increase in mast height.

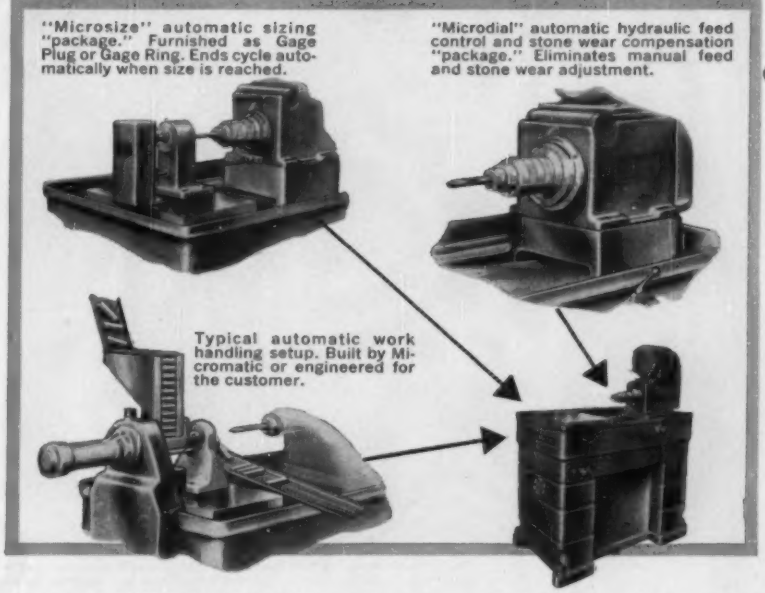
Knickerbocker Co, Truck-Man Div, 537 Liberty St, Jackson, Mich

Bronze welding rod, for welding bronze and brass and braze-welding cast iron and steel, is flux coated and is said to cut welding time as much as 15%, reduce gas consumption, and improve quality of welds. Rod, Redifluxed Bronze 30, melts at 1625 F, has good tinning qualities, and comes in 3/16 and ⅛-in. dia, packed in 10-lb tubes.

National Cylinder Gas Co, 840 N Michigan Ave, Chicago 11, Ill

Carbide-tipped saw blade, designed for cutting-out of critical areas of castings or molds for stress, strain, warp, and other testing, and for cross-sectional inspection, cuts a wide range of materials, including

How NEW "150" HYDROHONER Can Be Automated to Any Degree . . . Easily . . . Economically


"Microsize" automatic sizing "package." Furnished as Gage Plug or Gage Ring. Ends cycle automatically when size is reached.
"Microdial" automatic hydraulic feed control and stone wear compensation "package." Eliminates manual feed and stone wear adjustment.
Typical automatic work handling setup. Built by Micromatic or engineered for the customer.

The basic Model "150" Hydrohoner is a new, standardized and economical Microhoning machine . . . priced for manufacturers with limited capital or relatively short production runs.

The basic machine features automatic stroking and hydraulic initial tool expansion and collapse. Various degrees of automation can be easily added at any time to the basic machine as required by individual manufacturers' needs. Micromatic "package units" which provide specific automation functions are illustrated. Design of this basic horizontal machine and its stationary bridge facilitate addition of these "package units". For complete automation of the "150" Hydrohoner, Micromatic will build automatic work handling devices or assist users in designing their own automation of work handling.

Send coupon for complete information.

Learn how Microhoning will give efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

☐ Please have a Micromatic Field Engineer call.
☐ Please send Micromatic literature and case histories.

NAME_____
TITLE_____
COMPANY_____
STREET_____
CITY_____ ZONE_____ STATE_____ E

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

This 5000-ton Farquhar Split-Die Forging Press is used to form components of oil-well equipment at the Cameron Iron Works, Inc., Houston, Texas.

This Farquhar Split-Die Forging Press forms both bore and periphery in one fast, clean operation

The job was to press-forge parts weighing up to 2000 pounds having irregular contours on both the bore and the periphery. These parts in service had to withstand working pressures up to 15,000 pounds per square inch and temperatures up to 1600 degrees F. The successful solution was to put the job on a Farquhar Split-Die Forging Press.

This Farquhar Split-Die Forging Press applies horizontal forces from opposite directions as well as the normal down-action. The result is the production of high-strength parts with unusually clean surfaces whatever the contour. This cuts finish machining time to a minimum and provides forgings with uniform physical properties and controlled grain structure. Reported production savings run as high as 25% with rejects kept to a minimum.

For your tough forming jobs, investigate Farquhar Split-Die Forging Presses. Write today for complete information or ask for our recommendations and proposals.

Special Machinery Built to Your Requirements . . .

Our skilled staff will economically build your special machinery. We'll process your inquiry promptly.

A. B. FARQUHAR DIVISION
The Oliver Corporation
Press and Special Machinery Department
York 15, Pennsylvania

OLIVER Farquhar PRESSES

Also Manufacturers of Farquhar Conveyors

polyvinyl chloride, polystyrene, hard rubber, copper-plated printed circuit laminates, and light metals and alloys.

Forrest Mfg Co, Inc, Box L, Rutherford, NJ

Lathe block, for company's removable-block gap lathes, leaves a gap for purposes of accommodating large face plates. Large face plate can then be used for all chucking jobs. Distance from face plate to end of gap remains unchanged.

Nebel Machine Tool Corp, Cincinnati 25, Ohio

Precision micro-balls, ranging in size from 1/16 to ½ in. in dia and made to a tolerance of 0.000025 in., have been added to company's line of gages. There are 15 sizes, 3 balls of each size, and they fit into snap-in holes in carrying case.

Deltronic Corp, 1507-1509 Riverside Drive, Los Angeles 31, Calif

Machinery mount called Level-Rite is a self-leveling unit consisting of all-steel base with leveling screw and plate, combined with Unisorb vibration-damping pad. Available in seven models with loading ranges from 800 to 7500 lb per unit, mount comes in four sizes: 4 x 4, 6 x 6, 8 x 8, and 10 x 10 in.

Felters Co, Unisorb Div, 210 South St, Boston 11, Mass

Cam timer, type 571, is available with one through four poles, contacts for 30-amp resistive loads (and 1/3 hp) at 115v ac, speeds of 1 rpm to one rev per 8 days. Faster speeds can be obtained with lower switch ratings. Unit is 2¾ in. square by 2¾ in. deep, including motor. Bakelite housing includes switches and

"Now . . let's have it once more . . "

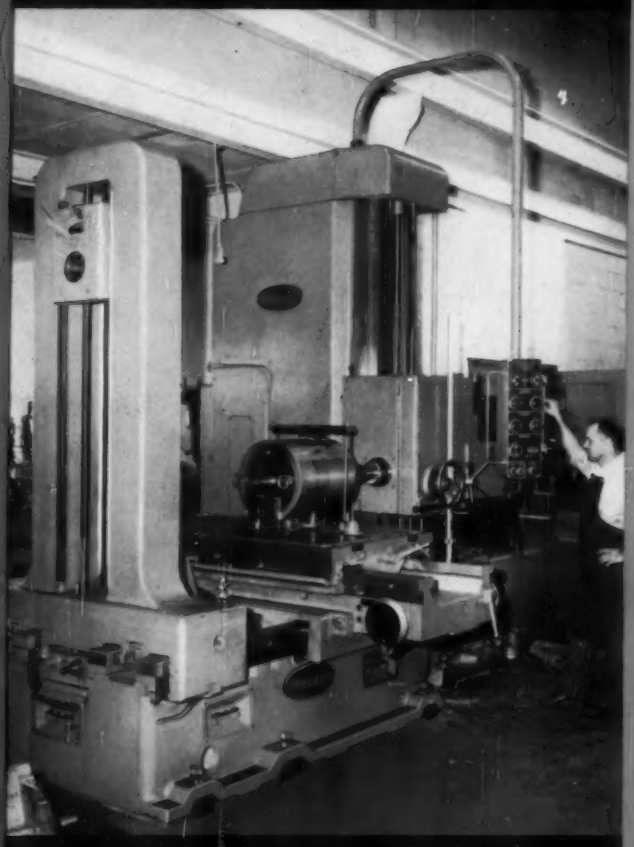
"The only Horizontal Boring Mill of modern design today is the

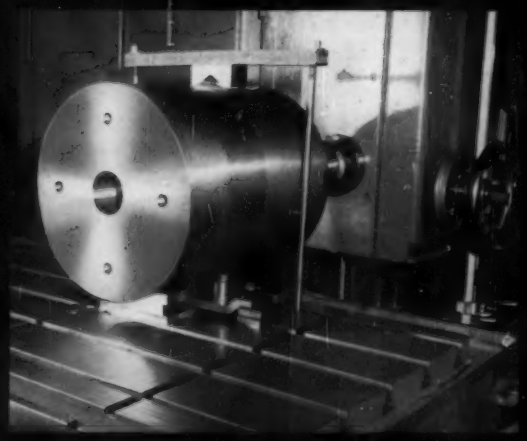
BULLARD

H.B.M., Model 75"

So says Mr. Arthur D. McDonald, President of E & M Enterprises, Inc. of Middleport, New York, builders of special machinery and tools for industry.

"There is no comparison" continues Mr. McDonald, "between our previous boring mill and the Bullard Model 75 — it is more accurate, faster, has more capacity, is simple to operate, has greater rigidity — all of which add up to more weekly production of . . . precision parts". . .





How about You?

Are you getting these same advantages in your manufacturing — if not, phone your nearest Bullard Sales Office for complete catalog or write

THE BULLARD COMPANY
BRIDGEPORT 9, CONNECTICUT

(PATENT APPLIED FOR)

NEW MANHATTAN SAFETY BACK FLARED CUP

Not simply a new safety "feature" . . . not merely a design "improvement." Here's a *totally new concept* of flared cup wheel design *and* construction . . . developed by Manhattan engineers to give the greatest safety and performance advantages possible for flared cup wheel users. Manhattan's revolutionary SAFETY BACK Flared Cup puts portable wheel *safety* where it counts the most—in *original* strength and breakage resistance!

SAFETY BACK makes obsolete ordinary safety features such as anchor bushings, safety rings, special hub mountings, or revolving cup guards. With SAFETY BACK, steel covers the *entire* back of the flared cup . . . extends down the side to offer a degree of reinforcement and breakage resistance never before possible!

NO OTHER WHEEL—AT ANY PRICE—OFFERS THESE EXCLUSIVE FEATURES

- **Greatest Initial Strength**
- **Highest Safety Factor**
- **Easy Mounting—Easy Operation**
- **Improved Mounting Base**
- **One Piece Assembly**
- **Requires No Adjustment**

Only SAFETY BACK gives you these features—*plus* Manhattan's custom-engineered abrasive bond for *faster* removal of *more* metal on your particular job—at no additional cost! For "More Use per Dollar" in portable grinding operations, you can't get a faster cutting, longer lasting—*safer* wheel than MANHATTAN.

Let a Manhattan abrasive wheel engineer show you the advantages of SAFETY BACK Flared Cups, and other types of Manhattan high speed, heavy duty abrasive wheels. Write for Bulletin 7157.

RM-788

GRINDING WHEEL INSTITUTE MEMBER

WRITE TO THE ABRASIVE WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Belts • Hose • Roll Covering • Tank Linings • Industrial Rubber Specialties • Abrasive and Diamond Wheels • Brake Blocks and Linings • Clutch Facings • Asbestos Textiles • Mechanical Packings • Engineered Plastics • Sintered Metal Products • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

factory-set cams. Switches are open blade, either SPST or SPDT. Three-level cams and a neutral position in SPDT switches can be supplied to permit control of up to 8 load circuits with a 4-pole timer.

Cramer Controls Corp, Centerbrook, Conn

Fast-drying enamel for use on all types of machinery and equipment is called BoGard Rapid Dry, and is said to possess durability of enamel and application and drying speed of lacquer. Paint dries in 15-20 min, comes in all standard colors, and is offered in 5-gal cans and 55-gal agitator drums. Bulletin RD-31.

Body Bros, Inc, Bedford, Ohio

Production shaving technique for shaving irregular shapes is said to make 100% shaving possible on surfaces up to ¼ in. thick. New process enables top and bottom edges to be chamfered at same time surfaces are shaved.

Impact Products, Inc, Box 7, Orangeville, Ohio

Machinery cleaner and flushing agent, Kleen-Flush, is non-toxic and non-irritating, and comes in plastic bottles. One 4-oz bottle, diluted with water, makes 5 gal of cleaner which removes grease, oil, and scum from coolant systems and machine surfaces.

DoAll Co, 254 N Laurel Ave, Des Plaines, Ill

Low-temperature soldering flux, called Amco 261, has been developed for use with alloys with melting points as low as 150 F. Used with conventional solders, cleaning action will begin at 150 F and continue right up to melting point of regular solder. Material is said to be entirely free of chlorides and rosin.

American Solder & Flux Co, 19 & Willard Sts, Philadelphia 40, Penna

Plastic goggles, Cesco 565, are molded from soft vinyl material, contoured to fit snugly, and fit over most eyeglasses. Wide curved lenses offer full vision; perforations on sides give adequate ventilation; choice of clear or green plastic lenses.

Chicago Eye Shield Co, 2329 Warren Blvd, Chicago 12, Ill

Cementable Teflon tapes are available in two styles: glass-cloth supported and unsupported. CDF line

NEW PUSH-LITE* SAVES HALF THE SPACE AND REDUCES COST

Using both a pushbutton and indicating light on one operation will soon be old-fashioned. In fact, it's a waste of money and space because one new Push-Lite unit will do both jobs.

The new unique Push-Lite with its button-shaped plastic lens combines the functions of both a pushbutton and indicating light. One push transmits the appropriate signal and, at the same time, energizes the indicating lamp.

Push-Lites are liquid-tight as are other operators and lights in the Westinghouse Oil-Tite* pushbutton line. Precision-machined fits and neoprene seals will not allow liquids to reach electrical parts.

For more information about Oil-Tite pushbuttons ask for the new booklet (B-7022) or the 72-page Pushbutton Guide (B-6749), a catalog of all Westinghouse pushbuttons. Write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. or call your local Westinghouse distributor. *Trademark J-30253

YOU CAN BE SURE...IF IT'S Westinghouse

of tapes bonds to almost any surface with ordinary adhesives. Produced in widths from ¼ in. to 12 in. and in thicknesses from 0.002 to 0.060 in., the tapes are available with either one or both surfaces treated for adhesion. Cementable surface is treated with sodium-ammonia mixture.

Continental-Diamond Fibre Corp, Newark, Del

Precision gear blanks for such applications as non-standard gears, ratchets, sector gears, handwheels, cranks, and pulley wheels, are available in four materials: 303 stainless, 24-ST aluminum, nylon, and linen phenolic. Three types are offered: pin-type hub, clamp-type hub, and hubless. Catalog available.

PIC Design Corp, Div of Benrus Watch Co, Inc, 477 Atlantic Ave, East Rockaway, LI, NY

Hex key holder, designated Handy Holder, is made of tough plastic material and has slightly undersize holes that hold wrenches snugly in place. Two models are available: one holds seven keys, sizes from 5/64 through ¼ in.; other holds ten wrenches, sizes from 0.050 through 5/16 in.

Hunter Tool, Box 564, Whittier, Calif

Synthetic coolant, Cool-Speed, is used with water vehicle to produce transparent solution which reportedly has excellent lubricity, cooling properties, and produces better finishes on cast iron, brass, aluminum, as well as various steels, including stainless.

Daubert Chemical Co, 333 N Michigan, Chicago, Ill

"—You're not listening to a word I'm bellowing!"

Passifying process known as Brasslyfe passifies and protects brass in one application. An air-dry spray material, it is claimed to passify brass and prevent tarnishing, and to provide a tough, durable coating that shows good weather and humidity resistance. It can be sprayed, dipped, or brushed on.

Logo, Inc, 12933 S Stony Island Ave, Chicago 33, Ill

Variable speed drive for use with company's Varidrive units is capable of maintaining any speed within its range within ¼ of 1% accuracy regardless of load fluctuations. Speed-sensitive Varitrol operates on a tight-loop, high-response, feed-back principle.

U S Electrical Motors Inc, Box 2058 Terminal Annex, Los Angeles 54, Calif

Magnetic hand sweepers, .called Magni-sweepers, for keeping plant work areas free of tramp iron, can be pushed by hand towed by a vehicle, or mounted on forks of lift trucks. Featuring Alnico V permanent magnets, sweepers come in widths ranging from 18 to 60 in., with sweeping clearances from 1 to 2½ in.

Magni-Power Co, Wooster, Ohio

Reinforced grinding wheels featuring new Safety Back design are said to be safer because steel covers the entire back, and extends down side to add more reinforcement. No more of wheel is covered than with revolving cup guard. Bulletin 7157.

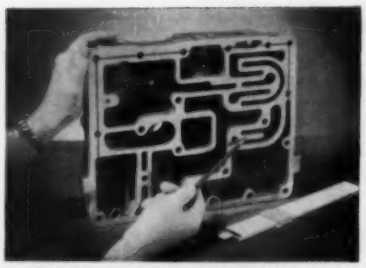
Raybestos-Manhattan, Inc, Manhattan Rubber Div, Abrasive Wheel Dept, Passaic, NJ

Hydraulic strainer unit notifies user when the hydraulic strainer is dirt clogged, acts as bypass valve, provides for easy strainer removal, and hikes usable oil supply. Telltale Strainer flashes red signal when strainer is clogged.

Rosaen Co, 1776 East Nine Mile Rd, Hazel Park, Mich

Reliance Miniature Clutch Available in Improved Version

New design makes possible the engagement or disengagement of any or all parts of power transmission drive installations, such as tachometer or counter drives. Improvement is said to prolong the life of instru-



MEEHANITE CASTINGS ARE MADE ONLY BY MEEHANITE FOUNDRIES

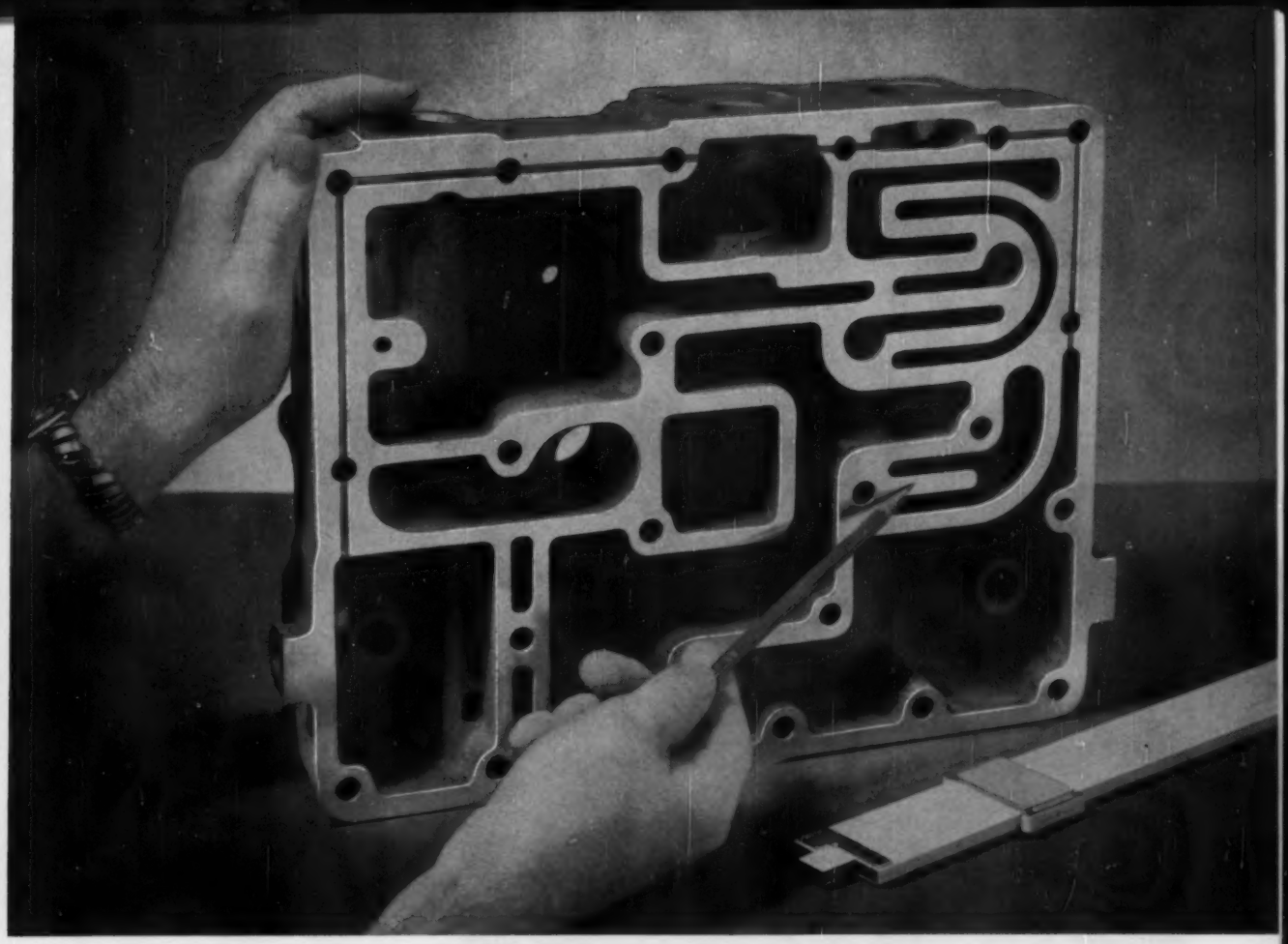
The American Laundry Machinery Co., Rochester, N. Y.
Atlas Foundry Co., Detroit, Mich.
Banner Iron Works, St. Louis, Mo.
Barnett Foundry & Machine Co., Irvington, N. J.
Blackmer Pump Co., Grand Rapids, Mich.
Centrifugally Cast Products Div., The Shenango Furnace Co., Dover, Ohio
Compton Foundry, Compton, Calif.
Continental Gin Co., Birmingham, Ala.
The Cooper-Bessemer Corp., Mt. Vernon, Ohio and Grove City, Pa.
Crawford & Doherty Foundry Co., Portland, Ore.
Empire Pattern & Foundry Co., Tulsa, Okla.
Florence Pipe Foundry & Machine Co., Florence, N. J.
Fulton Foundry & Machines Co., Inc., Cleveland, Ohio
General Foundry & Mfg. Co., Flint, Mich.
Georgia Iron Works, Augusta, Ga.
Green'ee Foundry Co., Chicago, Ill.
The Hamilton Foundry & Machine Co., Hamilton, Ohio
Hardinge Company, Inc., New York, N. Y.
Hardinge Manufacturing Co., York, Pa.
Johnstone Foundries, Inc., Grove City, Pa.
Kanawha Manufacturing Co., Charleston, W. Va.
Koehring Co., Milwaukee, Wis.
Lincoln Foundry Corp., Los Angeles, Calif.
Palmyra Foundry Co., Inc., Palmyra, N. J.
The Henry Perkins Co., Bridgewater, Mass.
Pohlman Foundry Co., Inc., Buffalo, N. Y.
The Prescott Co., Menominee, Michigan
Rosedale Foundry & Machine Co., Pittsburgh, Pa.
Ross-Meehan Foundries, Chattanooga, Tenn.
Sonith Industries, Inc., Indianapolis, Ind.
Standard Foundry Co., Worcester, Mass.
The Stearns-Roger Mfg. Co., Denver, Colo.
Valley Iron Works, Inc., St. Paul, Minn.
Vulcan Foundry Co., Oakland, Calif.
Dorr-Oliver-Long, Ltd., Orillia, Ontario
Hartley Foundry Div., London Concrete Machinery Co., Ltd., Brantford, Ontario
Otis Elevator Co., Ltd., Hamilton, Ontario

Send for your free single copy

This handy Meehanite Wheel Chart M-6 contains complete physical specifications.

Write today to Meehanite Metal Corporation, Department 5E, 714 North Avenue, New Rochelle, New York.

MEEHANITE®



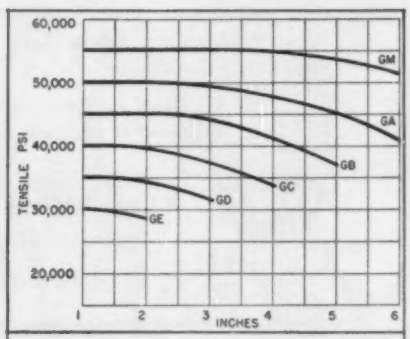
Rigidly controlled Meehanite metal assures uniform physical properties in all sections of complex castings.

This extremely complex Meehanite casting was made in large quantities for use in the production of military tanks. Every casting had to be completely free from defects in order to pass exacting inspection standards and uniformly high physical values were required, despite a number of intricate sections which varied from ¼" to 2" in thickness.

Meehanite metal may be poured in both heavy and light sections, minimizing the danger of draws, shrinks, openness of grain and varying physical properties. Containing a controlled quantity of graphite in a pearlitic matrix, Meehanite castings shrink 50% less than steel during solidification, hence eliminating casting strains, warping and cracking.

The uniformity and control of the microstructure of Meehanite castings results in high strength, improved wear resistance, excellent vibration damping, dimensional stability, good machinability and many other engineering advantages.

For more information write today for a free copy of the Meehanite Wheel Chart M-6 which contains complete physical specifications.



Effect of increasing casting dimension on tensile properties of Meehanite castings.

MEEHANITE BRIDGES THE GAP BETWEEN CAST IRON AND STEEL®

MEEHANITE METAL

MEEHANITE METAL CORPORATION, NEW ROCHELLE, NEW YORK

Here's a simple, economical way to turn water into an *all-around* superior grinding solution for ferrous metals and titanium! For ferrous metals, just mix 1 part W&B Grinding Concentrate 1500 with 150 parts of water. You'll get a low-cost, transparent mix that really keeps wheels open . . . settles chips instantly. Provides excellent rust protection and freedom from foam too. Grinding is keener . . . machines stay cleaner. Get complete information on this outstanding grinding concentrate. Fill out and return attached coupon.

W&B Grinding Concentrate 1500 is being used by many of the country's largest manufacturers.

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THE WHITE & BAGLEY CO.

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Originators of Grinding Lubricants

THE WHITE & BAGLEY CO., 90 Foster St., Worcester, Mass.

Please send me complete information on W&B Grinding Concentrate 1500 — and the list of large users.

Name ..... **Title** .....

Company ..... **Street** .....

City ..... **Zone** ..... **State** .....

☐ My plant has a tricky grinding problem on which we'd like advice. I've attached a letter describing it in detail. I understand that you offer this service without obligation.

ments and transmission equipment, and to reduce service cost to a minimum.

Once readings or operations have been completed, a slight turn of the control disengages the clutch until further readings are needed. Possibility of slipping is avoided because unit is equipped with positive drive.

Barbour-Stockwell Co, Cambridge, Mass

Rest buttons, made from alloy steel and hardened to R_c 58-60, are offered in two types and a complete range of sizes. Buttons with shanks are made in 16 sizes; buttons with drilled and counterbored hole for sockethead screw are made in 18 sizes. Catalog available.

Jergens Tool Specialty Co, 712 East 163 St, Cleveland 10, Ohio

Computer for Control of Grinder Eliminates Need for Match Gaging

Li-Ap Autopairer automatically controls any grinder to produce external pieces to fit bores within limits of desired radial play. Accuracy can reportedly be guaranteed down to 0.000040 in., regardless of type of grinding machine.

Device eliminates necessity for match gaging or selecting fits, dispenses with need for making the usual mechanical settings, or resetting for wheel wear. Backlash is electronically compensated.

Finished bores are placed on the ID gaging anvil one by one. If necessary, when unwieldy pieces are involved, they can be inserted in the ID gage which may be located up to

"There's nothing we can do about it—he met his quota three hours ago."

IN TRANSPORTATION EQUIPMENT, TOO

Sharonsteel Quality STANDS OUT

The quality standards and specifications of the transportation equipment manufacturers are known to be among the most exacting in American industry.

For this reason, many leading suppliers of automotive bus, truck and trailer chassies; railway cars, trucks, underframes and the exciting new air spring suspension (foreground) depend on Sharon Steel for high strength, low alloy strip and plate used in their products.

Other types of steel selected by the industry for their high quality are Sharon's line of stainless, coated and alloy strip and plate.

SHARONSTEEL

For 56 Years a Quality Name in Steel

253

SHARON STEEL CORPORATION, SHARON, PENNA.

CHICAGO, CINCINNATI, CLEVELAND, DAYTON, DETROIT, GRAND RAPIDS, INDIANAPOLIS, LOS ANGELES, MILWAUKEE, NEW YORK, PHILADELPHIA, ROCHESTER, SAN FRANCISCO, SHARON, MONTREAL, TORONTO

with the **LIPE Automatic MAGAZINE LOADING BAR FEED"**

says Screw Machine Foreman Willis J. Forbes*

Up to six months ago, the record per-machine production in our department for a single day was 5760 pieces. Our best monthly average was 5300 pieces per day. We tried out a Lipe A.M.L. to feed one machine, turning at the same cutting speed as before. In the first full day of operation, the A.M.L.-fed machine matched our top monthly average by 1:25 P.M. . . . and ended the day at 4:00 P.M. with a production of 7823 pieces! It has continued to turn out that number daily, *for six months!*

Why? The Lipe A.M.L. feeds stock continuously: No repeat motion for feed-outs. No down-time for changing feed fingers, or for remnant disposal. No cutting air—and when you stop cutting air, you start cutting costs. That's why we are now equipping our department throughout with Lipe A.M.L. Bar Feeds.

WRITE OR WIRE for a FREE Lipe Sales Engineering estimate of production increases, savings and amortization time of Lipe A.M.L. Bar Feeds in your production layout.

*Photographer's models and pseudonyms used to protect company identity and confidential information.

Lipe-ROLLWAY CORPORATION SYRACUSE 1, N.Y.

MACHINE TOOLS • HEAVY-DUTY AUTOMOTIVE CLUTCHES • PORTABLE POWER HACK SAWS

NEW SHOP EQUIPMENT

5 ft away from the grinder. Rough stem, or work, is then placed in grinding position, and automatically ground to fit. No gage readings are necessary.

Industrial Gauges Corp, EAM Division, West Englewood, NJ

Torch handle, No. 403, connects directly to standard 3/16-in. Prest-O-Lite assemblies through A-size LH threads on the needle valve. Overall length is 7 9/16 in., weight is 10 oz. Catalog F-6995.

Linde Co, Div of Union Carbide Corp 30 E 42 St, New York 17, NY

Magnetic roller channels are said to expedite shearing of light and medium weight sheet steel as heavy as 14 gage. As sheet is fed through shear, magnetic rollers seize and guide it into position against back gage. Roller channel assemblies are offered in lengths of 24, 36, or 48 in. Optional lengths, in 2-in. increments, are available on special order.

Magni-Power Co, Wooster, Ohio

Lens cleaning tissues will clean and fog-proof lenses in one operation—with plain water. Lenses are wetted and wiped with No-Fog tissues. Available in plain boxes or light and heavy-duty stations for plant use.

Carhoff Co, 11706 Kinsman Rd, Cleveland 20, Ohio

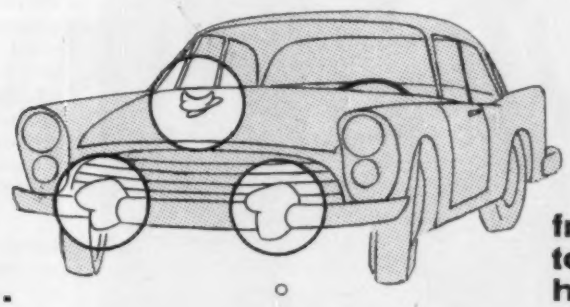
Ball bearings featuring fractured outer rings are said to have increased life and performance. By fracturing

"All right, McGowan. I'll give you a raise on one condition—look disappointed when you go back to the shop."

HY-PRO specialists will show you how a little difference in design can deliver

100 times longer tap life

The jobs where tap life can be increased a hundredfold are obviously exceptional, but it *can* happen, as these cases prove, even in the cost-wise automobile industry. That's why it pays to question tap costs on any job. Job analysis by HY-PRO specialists *regularly* leads to savings as high as 50% — with special taps when required — but often with a simple switch to the right style of standard taps. Why not find out if your tap costs are low as they can be? It costs nothing to consult the HY-PRO specialists.



from 100 to 10,000 holes per tap...

The standard spiral point tap formerly used for tapping an automobile bumper bracket lasted for 100 holes or less, due to breakage. The cause was misalignment which could not be corrected without prohibitive expense for jigs, and for special controls in preceding operations. HY-PRO specialists designed a no-flute, 3-spiral groove tap with special heat-treatment which boosted production to 10,000 holes per tap — with no change in job conditions. Result . . .

98% SAVINGS in tap cost

from 25 to 10,000 holes per tap...

In a tapping operation on a die cast automobile ornament, the standard 3-flute tap being used broke after an average run of 25 holes. The cause was spalling and binding of the relatively soft alloy around the tap. HY-PRO specialists recommended an oversize 3-flute plug point tap with minor flute modifications. Binding was eliminated, and clean cut threads permitted easier assembly. Production was increased to 10,000 holes per tap. Result . . .

99% SAVINGS in tap cost

HY-PRO

REG. U. S. PAT. OFF.

The Tap Engineering Specialists

Why "special" tap development brings you better "standards"

Even though you never need "specials", you benefit by HY-PRO leadership in special tap design. The intensive research and testing involved is all reflected in constant improvement of HY-PRO standard taps. HY-PRO specialists can often point out opportunities for substantial savings, even in tapping operations you've considered satisfactory. For information, write: Dept. B.

ASK FOR STOCK LIST OF SPECIAL TAPS AVAILABLE FOR IMMEDIATE DELIVERY

CALL YOUR LOCAL **HY-PRO DISTRIBUTOR** FOR STANDARD TAPS FROM STOCK
HY-PRO TOOL COMPANY • NEW BEDFORD, MASS., U.S.A.

Add flexibility to your machines with low-cost speed control

Choose from 8 sizes . . . ¼ to 15 hp . . . 1.75:1 to 4:1 speed ratio. Converts any standard constant-speed motor into variable speed drive.
MAXIMUM TO MINIMUM OUTPUT SPEED POSITIONS

REEVES®

Vari-Speed Motor Pulley

Get greater productivity . . . run at the most economical production speed . . . handle production or process variables with the same machine—install low-cost REEVES Vari-Speed Motor Pulleys!

Change machine output speeds . . . instantly and accurately . . . without interrupting production. Positive "close-grooving" lubrication assures free sliding discs for *easy, sure* speed adjustment. Minimum parts mean long, trouble-free service.

Write today—A29c-V545; we'll send your copy of the Motor Pulley bulletin complete with rating data and dimensions.

REEVES PULLEY COMPANY

Division of **RELIANCE** ELECTRIC AND ENGINEERING CO.

Columbus, Indiana

outer ring at one point, bearing may be opened sufficiently to introduce maximum number of balls. Technique is said to increase load capacity, and simplify retainer construction, without weakening the bearing. Fractured ring closes by its own resiliency and is secured by circumferential holding wires or rings. Catalog 57.

Split Ballbearing Corp, Lebanon, New Hampshire

Thermo-setting plastic, designated Certified Metaplastic, is an epoxy resin used to repair dents, holes, breaks, and scratches in metal. It adheres to iron, steel, aluminum, wood, glass, and most plastics, and will bond metal to metal. It is not affected by acids, alkalis, solvents, or greases, is applied cold, and has no toxic effects.

United Laboratories, Inc, 16801 Euclid Ave, Cleveland 12, Ohio

Lubricant, Gear-Moly, reportedly reduces bearing wear and failure and lengthens gear tooth life. Material contains molybdenum disulfide particles, suspended in SAE 90 gear oil. Recommended usage is about 2 oz per lb of oil or grease. Price for 8-oz can is $1.98.

Pacific Lubricants Co, 5807 East Beverly Blvd, Los Angeles 22, Calif

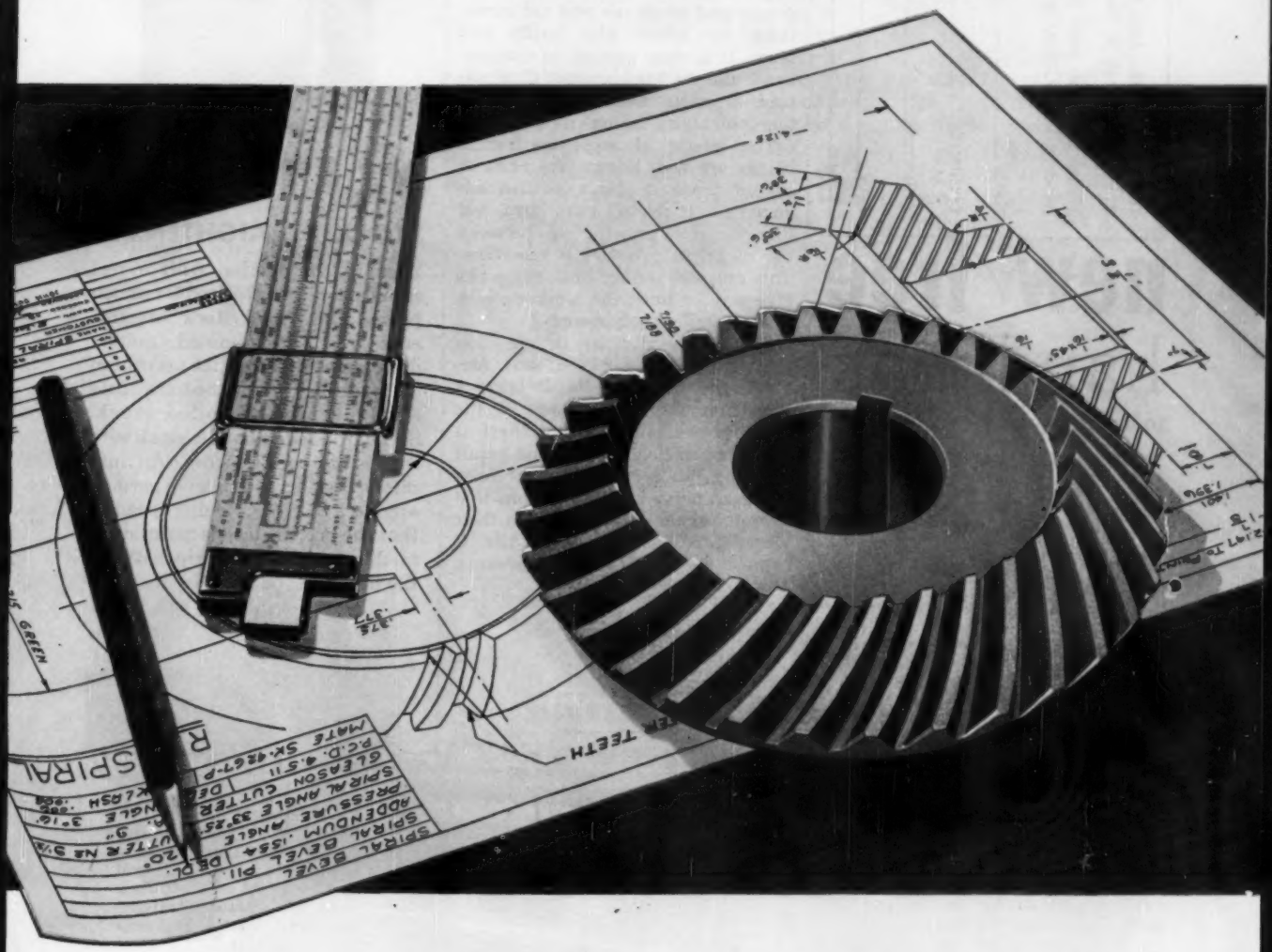
Lapmaster tooling, consisting of combination lapping and conditioning rings, is available for precision mechanical lapping of flanged faces of radial engine cylinder heads. Units replace standard conditioning rings on lap plate of machine.

Crane Packing Co, Dept AMN, 6400 Oakton St, Morton Grove, Ill

"Finster always has a chip on his shoulder!"

"ENGINEERED QUOTATIONS"

When our engineers study our customers' prints, they look for ways to improve gear performance, ways to simplify gear installations, ways to cut gear costs. When they find a way that they consider better they report it to the customer for his consideration. Very often these "engineered quotations" are accepted. Such careful scrutiny of every engineering and manufacturing step by *gear specialists* is one reason why so many manufacturers use Automotive Gear Division as their "gear department". May we submit an "engineered quotation" on your gear requirements?



EATON

AUTOMOTIVE GEAR DIVISION
MANUFACTURING COMPANY
RICHMOND, INDIANA

GEARS FOR AUTOMOTIVE, FARM EQUIPMENT AND GENERAL INDUSTRIAL APPLICATIONS
GEAR-MAKERS TO LEADING MANUFACTURERS

TORIT MFG. CO., Attn.: Mr. Chase, Sales Mgr.
311 Walnut Street, St. Paul 2, Minn. Phone: CApital 2-4419
Please send me your new free Handbook, "Torit's Guide to Modern Dust Collection".

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to answer your dust problems

Mail coupon for details on lower costs, higher worker morale possible with Torit Dust Collectors.

Here are up-to-date facts on industrial dust problems. How to solve them efficiently at low cost with flexible, economical Torit Dust Collectors. Details on all Torit units, helpful information, charts, applications, etc. 28 pages, fully illustrated and it's yours FREE. Write or use coupon above for your copy today.

TORIT MANUFACTURING CO.
311 Walnut Street, St. Paul 2, Minn. Dept. 406

Round Table...

VIBRATING NERVES

Is it possible for a worker to become accustomed to the noise of his own machine, yet be bothered by the sounds of a less noisy machine next to him?

Noise in the shop is a problem which is close at hand. It is a problem within the sphere of the employer and employee and not something far afield like tariffs and taxes. It is close enough to comprehend and to fight against. The nature of noise and the techniques for controlling it are well known.

The effects of noise on human beings are well known but noise is one of those insidious, patient adversaries. It doesn't push hard, but like the tree growing up between the rocks, its pressure is relentless. This pressure pushes until the rocks give way or until the worker's ears and nerves are shattered.

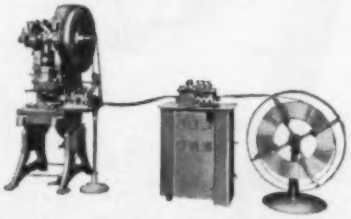
The effects of noise in the shop are detrimental but the time factor is the real problem. It takes a long time for the pressure of the noise to exact its toll, but there is never much doubt about the result and the toll is a high one. Noise produces nerve-rasping tensions that keep its victims from enjoying their work, their home and their life. It causes chronic fatigue, insomnia,

"Your pay envelope will be a little heavier this week, Morris; we're using heavier stock on the envelope!"

FLEXIBILITY
in Stock Straightening

WITTEK
STOCK STRAIGHTENERS

Used in conjunction with a reel stand and automatic feed for punch presses, the Wittek Stock Straightener is a self-contained, motor-driven unit designed for maximum efficiency in the continuous straightening of coiled stock. Standard models handle stock with widths up to 12 inches. An infinitely variable speed drive permits any desired straightening speed so that the proper slack is maintained in the straightened strip between the unit and the press feed.



This typical Wittek automatic production feeding setup includes—Wittek roll feed mounted on the punch press, Wittek stock straightener, and Wittek self-centering reel stand.

Write for full particulars

WITTEK Manufacturing Co.

Production Feeding Equipment

4320 W. 24th Place • Chicago 23, Illinois

this ERIE press speeds extrusion

Presses like this—made expressly to extrude graphite electrodes—are routine specialization for Erie Foundry Company. This 450-ton press is now performing in the field, in typical trouble-free Erie fashion, providing faster extrusion work. The bed plate, rigidly attached to the press, eliminates the need for lining-up at our customer's plant, and assures continued accurate alignment. Die changes can be made in a matter of minutes by removing the clamp nuts and separating the half clamps by cranking.

Smoother Tamping Action

The operator controls the action of this Erie press smoothly and accurately by moving a hand lever in the same direction the ram travels. The further the lever is moved from vertical, the faster the ram travels . . . no other control valves are required. Fast advance and reverse speeds are achieved by auxiliary cylinders.

A similar carbon extrusion press rated at 2000 tons is now being assembled in the Erie Foundry Company plant. We invite you to see this press.

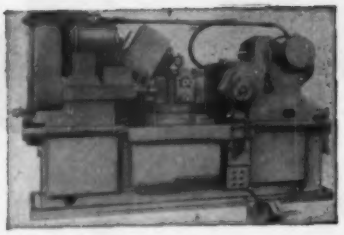
Erie Foundry Company would like to quote on your requirements. Please write

Hydraulic Press Division

ERIE FOUNDRY CO. ERIE 4, PA.

World's greatest name in forging machines and hydraulic presses since 1895

Here's what is meant by "1·2·3" in the GOSS & DE LEEUW AUTOMATIC CHUCKING MACHINE



The outstanding advantage of this machine is ability to handle operations on one, two or three ends of a piece simultaneously or in sequence, without changing set-up or reloading. It is the only standard machine that will do this.

"1-2-3" means ability to handle work requiring machining operations on one, two or three ends simultaneously or in sequence—a method exclusive with Goss & DeLeeuw and offered on this machine.

For complete details ask for illustrated bulletin. Send samples of your work for time and cost estimates.

GOSS & DeLEEUW QUALITY PRODUCT-QUALITY SERVICE

GOSS and DE LEEUW

MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

weary souls and cranky people. Noise causes human motors to race and keeps many people running so fast that they cannot count their blessings but only their birthdays.

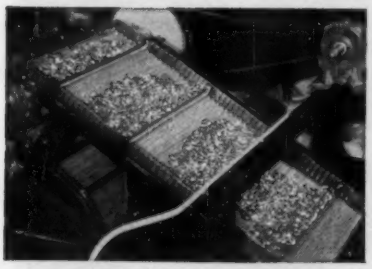
A conscientious effort on the part of management can reduce the noise in the shop to a great extent. In many cases it is the result of defective machinery. There are plenty of old lathes in use that sound like rock crushers; shapers are probably worse offenders with a hammer blow at each reversal of the ram. In these cases the noise is the result of worn gearings and gears that should have been replaced years ago. The presence of noise not only means a poor machine turning out inaccurate work, but it also means unhappy employees. It seems that the noise that enters via their ears must get out of their system via their mouths. As a result they shout at their fellow workers, they shout about their boss and they shout at their families.

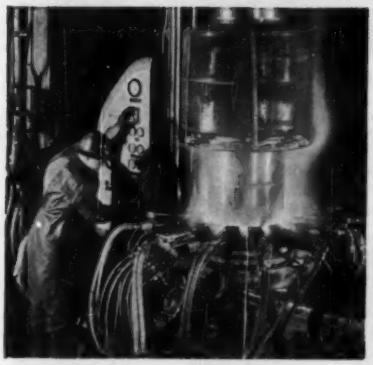
The man who must listen to grinding gears and pounding bearings loses his interest because he knows full well that this noise is completely unnecessary. There are some backward, narrow-minded supervisors and plant managers who contend that the shop should be noisy because it is a shop. They excuse the noise by explaining it as being necessary to keep the employees awake and alert. Instead, it beats them into a state of sub-consciousness.

There are many noises that are not the result of defective machinery and they cannot be readily eliminated at the source. The whine of the abrasive cutoff wheel and the clunk of the piercing punch are sounds which originate where the

(Continued on page 240)

"Congratulations, Finster—this is the earliest you've been late!"





You need MORE than these to Heat Treat Metals!

The science of heat treating has become of vital importance to many manufacturing operations. Without the radical improvements of the properties and characteristics achieved in metals and alloys by heat treating, many of the nation's most important products could not be made.

To perform the appropriate type of heat treatment, such as annealing, normalizing, quenching, tempering, carburizing, controlled atmosphere hardening, stress relieving and others requires specialized, intricate, and expensive equipment such as is illustrated here.

But *more* than such equipment is needed. The most modern and highly specialized equipment is useless without the correct combination of operational skill and technical experience that has been developed over years of practical operating practice. Equipment and materials are important, but the *essential* factor in heat treating operations of all kinds is the human touch and the practiced hand.

The members of the Metal Treating Institute listed here are the recognized leaders of the commercial heat treating industry. They are specialists possessing the equipment, the technical skill, the years of experience, and the personnel with which to solve your heat treating problems all under one roof.

When you need complete heat treating services or want consultation concerning heat treating or engineering or design problems, write any of the companies listed. All inquiries will receive prompt attention.

WRITE FOR A COPY OF A BOOKLET "A REVIEW OF SALT BATH CARBURIZING".

THERE'S A HEAT TREATING SPECIALIST NEAR YOUR PLANT

American Metal Treatment Co.
Elizabeth, New Jersey
Anderson Steel Treating Co.
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Kitchener, Ontario, Canada
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Bennett Heat Treating Co., Inc.
Newark 3, New Jersey
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Bridgeport, Connecticut
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Houston 11, Texas
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Dominy Heat Treating Corp.
Dallas, Texas
Drever Company
Philadelphia 33, Pennsylvania
Greenman Steel Treating Company
Worcester 5, Massachusetts
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Hollywood Heat Treating Co.
Los Angeles 38, California
L-R Heat Treating Company
Newark, New Jersey
The Lakeside Steel Improvement Co.
Cleveland 14, Ohio
Metallurgical, Inc.
Minneapolis 14, Minnesota
Metallurgical, Inc.
Kansas City 8, Missouri
Metlab Company
Philadelphia 18, Pennsylvania

New England Metallurgical Corp.
South Boston 27, Massachusetts
Paulo Products Company
St. Louis 10, Missouri
Pittsburgh Commercial Heat Treating Co.
Pittsburgh 1, Pennsylvania
Pittsburgh Metal Processing Co., Inc.
Pittsburgh, Pennsylvania
The Queen City Steel Treating Co.
Cincinnati 25, Ohio
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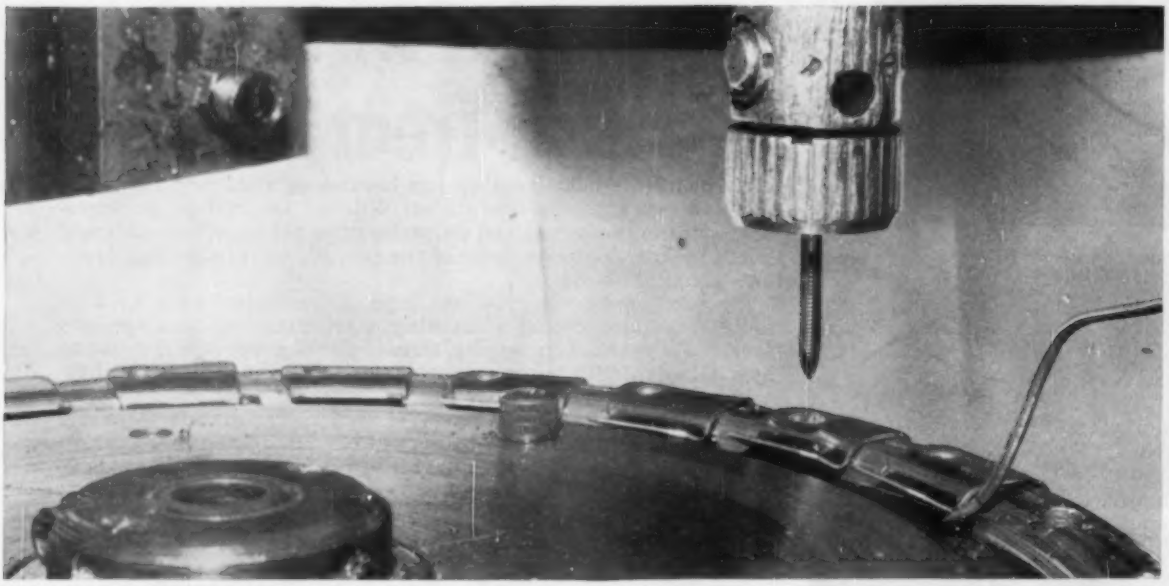
Syracuse Heat Treating Corp.
Syracuse, New York
Winton Heat Treating Company
Cleveland 16, Ohio

This advertisement sponsored by those Companies which are members of the Metal Treating Institute.

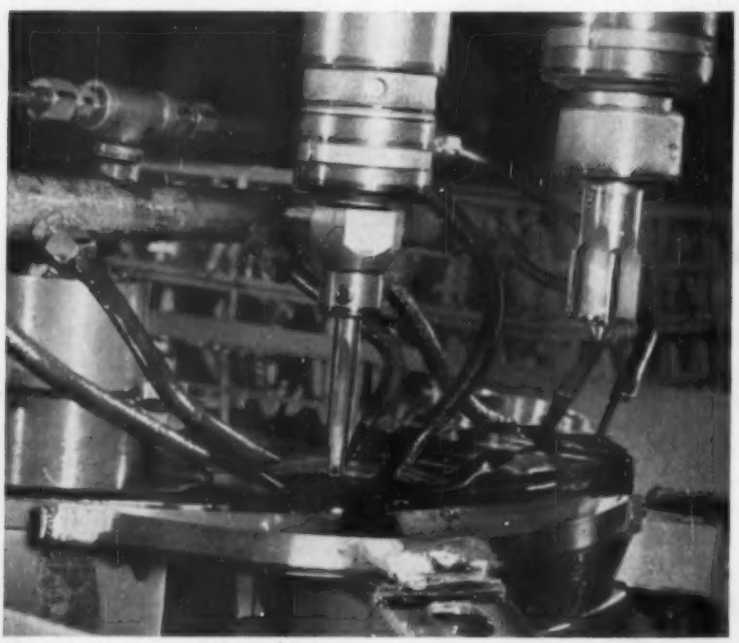
METAL TREATING INSTITUTE

271 NORTH AVENUE
NEW ROCHELLE, NEW YORK

Cutting Tools and Gaging



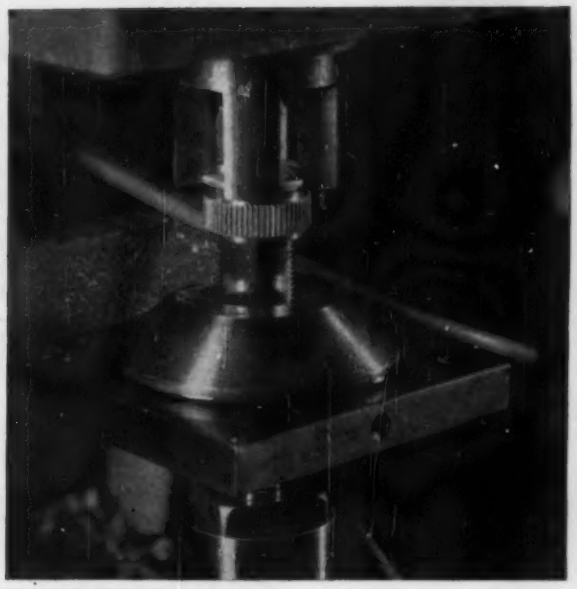
2900 TAPPED UNITS PER HOUR—With the Besly 8-32NC Spiral Pointed Tap set up in the above completely automatic "special" machine, Keades, Inc., Wyandotte, Michigan, gets a production rate of 2900 units per hour on "t"-nuts, bolts, rivets, clips, and similar parts. Upon request by Keades' men, Besly's Engineering Service designed this tap to fit the automation set-up desired. Previous manual tapping methods proved too costly and slow — no volume. Today, Keades, Inc. has two of these machines humming merrily along producing parts at tremendous rates — using this Besly 8-32NC Spiral Pointed Tap. Another example of how Besly's Engineering Service helps solve tap problems for special applications.



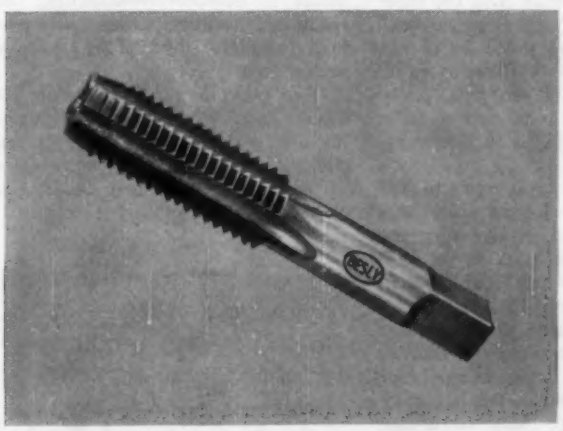
MATCHED TO THE JOB—At The Chicago Screw Company, Bellwood, Illinois, two sizes of Besly taps, poised above an indexing table, are ready to tap C-1141 steel parts. Operating alternately, the smaller ¾"-24 Besly tap quickly threads a hole, then the work indexes beneath the 15/32"-24 Besly tap and a larger hole is threaded. By using Besly's Engineering Service, this company realized lower costs and a better job. The right taps were carefully selected and matched to the specific threading requirements.

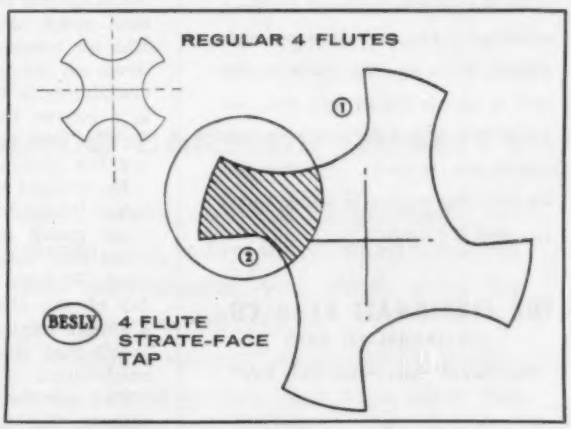
PRECISION ACCURACY— Bodine Electric Co., Chicago, uses a variety of Besly-Metro Gages to assure precision accuracy of parts for electrical motor production. Asked why he used them, A. Wermund, inspection foreman, says, "Last longer — sturdier built."

Methods . . . by BESLY



THREADING ALUMINUM RINGS — The parts shown here are aluminum coupling rings made for electrical connection units. Because aluminum, by nature, expands and contracts readily, tapping is difficult. Tapping, therefore, is done from .005″ to .007″ over basic tolerance. In the photo, left, a larger coupling ring is ready to be tapped with a 1¾″-18 unified thread Besly Tap on an automatic screw machine. For smaller coupling rings, photo right, the small size and lightness of the piece necessitated the design of a special fixture and set-up to hold the ring while tapping. The hole is threaded ⅛″ deep with a ⅝″-24 Besly Tap. The fixture holding the ring is pneumatic and produces about 450 threaded aluminum rings per hour. Besly helped solve the problems of tapping aluminum for this manufacturer by providing taps of the right size and style to fit the production requirements. Besly's Engineering Service is always available for cutting tool and gage users.





NEW "STRATE-FACE" TAP FOR CAST IRON — This new Besly tap has been designed to produce freer cutting, more accurate tapped hole size, longer tap life and less tap breakage, in cast iron parts. It features, (1) straight cutting face ("Strate-Face") with accurate controlled rake angle, (2) new flute and core design with high strength zone resulting in a stronger tap, (3) "Stemite" process protective coating prevents abrasion, stops welding and adds lubricity for longer true-size tap life. Besly "Strate-Face" Taps are available in sizes #6 through ¾″ and should be used only for cast iron tapping.

Prove to yourself that Besly Cutting Tools and Gages produce better results. Put them on trial on your toughest jobs, and check the difference in longer tool life, less down time, fewer rejects and faster production. If you'd like to try Besly tools or use Besly's Engineering Service, see your Besly distributor for details, or write us . . .

Engineering, Service and "Specials" . . . are a Besly Specialty

BESLY

BESLY-WELLES
CORPORATION
Est. as C. H. Besly & Co. 1875
120 Dearborn Ave., South Beloit, Illinois

TAPS • DRILLS • REAMERS • END MILLS • TOOL BITS • GAGES
CARBIDE TIPPED TOOLS, BLANKS, TOSS-AWAY INSERTS and HOLDERS

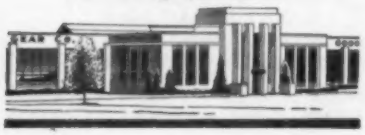
A little GOLD in our hair

PRESIDENT, THE CINCINNATI GEAR CO.

We're older than we look. In fact, our firm is 50 years old this year, and while we haven't *actually* taken to tinting our hair gold, we *are* doing our best to let everyone know about this, our golden anniversary. Because we think it's something of an accomplishment — 50 years of uninterrupted progress and growth and leadership in gear-making that have made our reputation "good as gold." That reputation has been as much the result of adhering to some old-fashioned ideas about craftsmanship, service and attention to details as it has been the result of aggressive pursuit of the latest technological advancements in gear manufacture. It's a reputation we've worked hard to earn in the 50 years past, and one we'll work equally hard to perpetuate in years to come . . . a reputation for producing the best in custom "gears . . . *good gears only.*"

THE CINCINNATI GEAR CO.
CINCINNATI 27, OHIO
Fifty Years of "Gears—Good Gears Only"

CINTI®



tool contacts the work and are inherent in the operation. In general, they cannot be eliminated at their source but there is no reason why the employees must hear each sound repeated three or four times as it bounces off the walls and ceilings and reverberates through the shop. Sound-proofing applied to the ceiling and walls is an effective way to combat these noises.

The management that takes a far-sighted view will make an effort to reduce and eliminate shop noise as far as possible. They will find that action taken in this direction will result in a net gain with improved employee relations and increased production.

Ernest Jones
Bronx, NY

To LET our emotions get away from us in this problem means we get nowhere and accomplish nothing. The employee is worked up and nervous about a high-speed punch press moved in next to his machine. The boss feels he is trying to make trouble, and has talked about firing the employee.

Good leadership would examine the facts. Is it the noise that has the employee nervous? Did the foreman check with other employees? Has he considered methods to cut down on the noise? We have many complaints in the day's work. There is a reason for them, and a little tact on our part helps in determining the reason.

No attempt has been made to find out if this employee is afraid of this other punch press. Is it really the noise that bothers him? Is he jealous? Perhaps he is just resentful of the change. In many cases a simple explanation of the change is all that is necessary to remove resentment.

Fnd out the reason for all complaints. Get tough only as a last resort.

A E Salmons
Norristown, Penna.

THE SUDDEN outburst of Ed's workman, Ritter, over the nerve-racking noise caused by the installation of a new press, leads me to feel there must be some justification for the man's complaint. When I read over the Round Table issue my first reaction was to consider it as being the ravings of a gripe-soaked individual who is always inclined to object to anybody or anything at anytime. As a consequence of my burned-up conclusion I took the trouble to do a little investigating on the effect of noise upon the average worker.

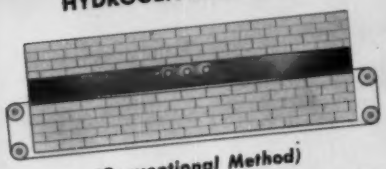
In the "Library Journal" of May 1, 1951, Dr James McCartney, in his paper "Noise Drives Me Crazy," presented to the Pennsylvania Medical Association, says "Noise may lead to deafness, but of all the hazards, the effect upon the nervous system is most serious." It is my impression that Ritter is the victim of a forerunner of a breakdown of his nervous system and certainly deserves every consideration possible. We don't hesitate to do everything in our power to protect the safety of the industrial worker and we are constantly on the lookout for any means whereby we can improve the worker's health so why shouldn't we do what we can to eliminate any or all conditions which tend to wreck his psychological equanimity as well.

While not so easy to detect as some of the regular ailments an individual is inclined to suffer, the destructive effect of unusual noises does impose a hardship on him which, if allowed to continue, may result in completely wrecking his emotional stability, which could lead to a complete physical and mental breakdown.

"The nervous system controls the higher faculties of the individual—his ability to work, his mental capacities, and even his expression of personality." It can readily be

"He's slow, but he does such lousy work I don't mind waiting."

Vacuum Sintering

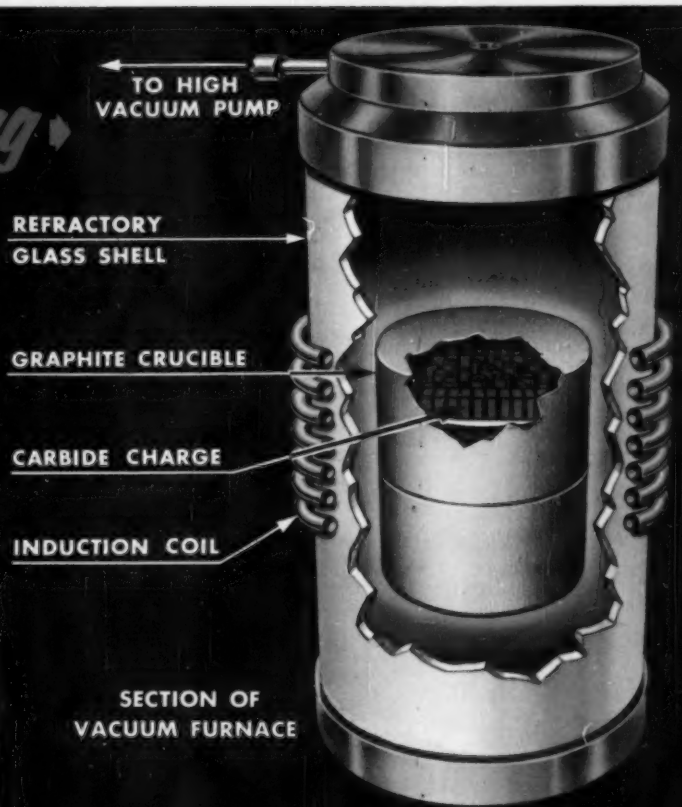


HYDROGEN SINTERING

(Conventional Method)

Oxidation is the primary enemy of carbide quality. The conventional method of sintering calls for the blank to be heated in a hydrogen atmosphere in an attempt to "scavenge" oxygen from the blanks. Unfortunately, this process results in the formation of hydrogen compounds which also reduce carbide quality. Also, it is difficult to maintain hydrogen furnaces to the critical temperature requirements.

Vacuum sintering has supplied the answer to the problem. The blanks are electronically heated in a near-perfect vacuum. No oxygen or hydrogen is present. No contamination can occur.



HOW Vacuum Sintering GUARDS CARBIDE QUALITY

Industry has been greatly impressed with the superior performance of the new "premium grades" of tungsten carbide. Most companies in the field now sell one or two. These premium grades must be processed by the "vacuum sintering" method in order to maintain the higher quality standards.

In years to come, all carbide plants will use the vacuum sintering process exclusively, as obsolete hydrogen equipment wears out and is gradually replaced. But, today, if you want premium tool performance you must insist on vacuum sintered carbide.

Valenite vacuum sinters all 14 grades, not just one or two. And remember this . . . Valenite supplies these 14, premium quality, vacuum-sintered grades at the same or lower prices now charged for the regular hydrogen sintered carbides!

Vacuum Sintering is only one of Valenite's advanced techniques.

VALENITE® METALS

DIVISION OF THE VALERON CORPORATION

BOX 205 • ROYAL OAK, MICHIGAN

FREE . . . your copy of the Valenite Handy Reference. Packed with useful tables and formulas. The most useful book of its kind. Write for your copy (on your company letterhead, please.)

– turn page

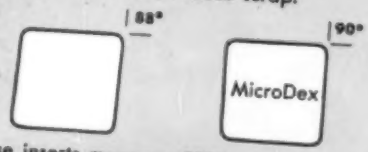
Specify Valenite MICRODEX* Throwaway Inserts

for • *Maximum efficiency* • *Lowest tool cost per part*

*Valenite MicroDex Inserts are ground by an exclusive technique to give you *extra* precision and *three great advantages* over other inserts . . .

ADVANTAGE #1

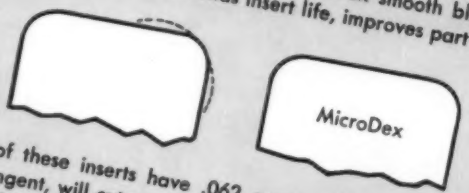
CLOSEST TOLERANCES — MicroDex Inserts index accurately for repeat operation *without* resetting the tool — you cut machine down-time, reduce scrap.



Both of these inserts measure .5000 across the sides — but one is out of parallel, can not be indexed accurately. The MicroDex Insert is always parallel, and well within the plus or minus .001 standard tolerance.

ADVANTAGE #2

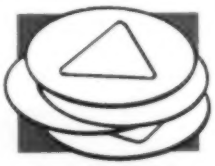
TRUEST TANGENCY — The MicroDex smooth blend of corner radii to sides extends insert life, improves part finish.



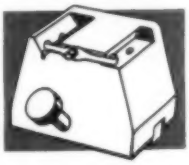
Both of these inserts have .062 corner radii — but one is not tangent, will cut on a sharp point. MicroDex processing methods assure perfect tangency on all corners of all inserts.

Prove it to yourself. Before approving any inserts for use in your plant, check and compare their accuracy with the Valenite Insert Checking Kit . . .

1. Set of Comparator Templates giving ideal insert geometry, standard tolerance range, etc. Covers all standard squares, triangles.



2. Shadowgraph fixture to rapidly align and support inserts on comparator for checking.

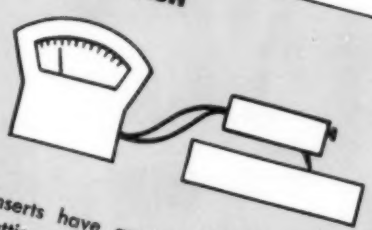


For complete details write to address below

Valenite offers the most complete line of throwaway inserts in industry . . . 55 styles and sizes. And there are more grades to choose from so you can match the requirements of your job exactly. There are utility inserts (ground top and bottom only) as well as the super-precise MicroDex.

ADVANTAGE #3

FINEST MICROFINISH



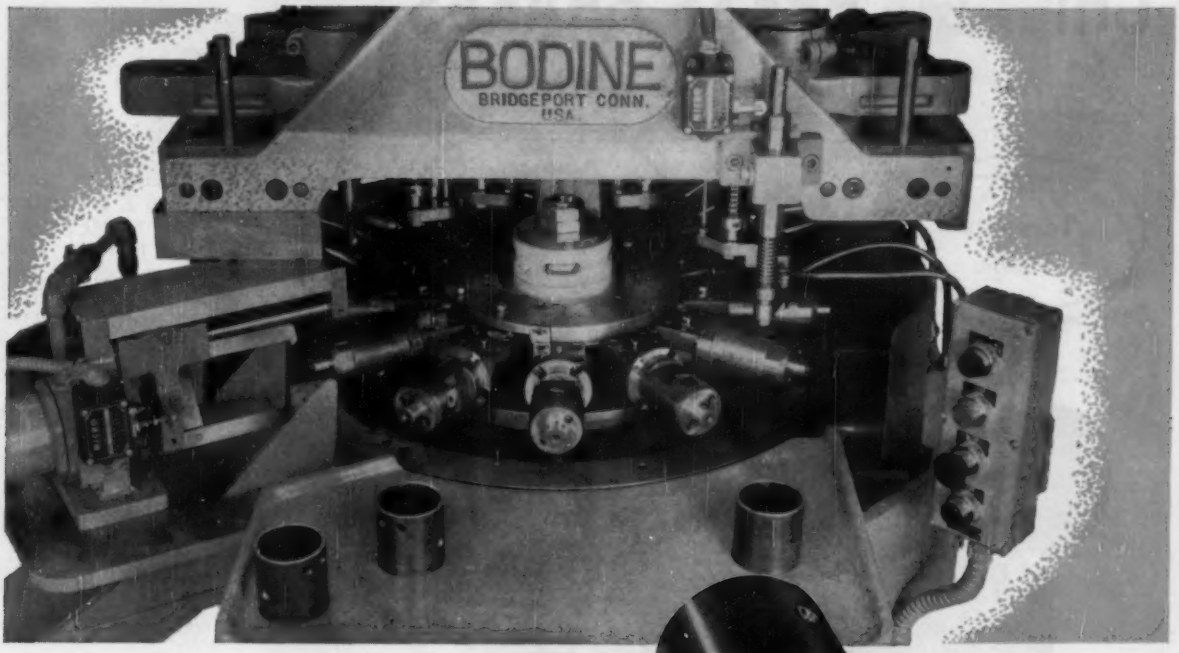
MicroDex Inserts have an extra-fine grind to give you smoothest cutting, best part finish and longest insert life.

VALENITE®
METALS

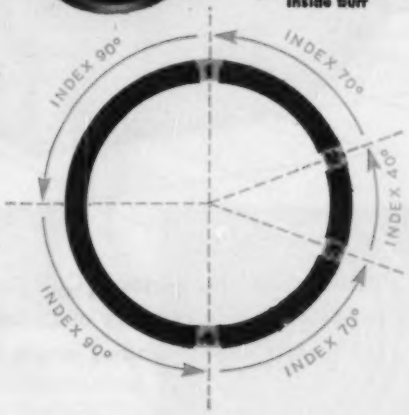
Division of the Valeron Corporation
Box 205 • Royal Oak, Michigan

Write now to reserve your copy of the new Valenite catalog.

Bodine case history no. 44



1 Drill and countersink
2 Drill
3 Drill
4 Drill and countersink
5 Ejects stripping inside burr



here's how the automakers streamlined small motor production on BODINES

This Bodine Case History is really only one of many closely related installations in the key auto-electrical plants. The fact is that essentially ALL the small motors that power windshield wipers, window lifts, heaters, seat adjusters, etc., on today's cars are made this way . . . and on Bodine machines.

Parts being made on this 42-30 Bodine are tubular motor frames. On the production line, tube sections are conveyor-fed and held as shown on horizontal automatic indexing fixtures. After machining, they are automatically ejected by the stripper mechanism shown at the left of the machine, while special carbide inserts designed into the fixture remove inside burrs.

In the photograph above, auto-loading conveyor and locking mechanisms have been removed to show tooling.

Simple, rugged Bodine VERTICAL tool spindles drill and countersink two holes and drill two additional holes through the walls of the tubing, as shown in the diagram . . . all accurate within close limits for position and angularity. The same machines can be quickly re-tooled for changes in motor sizes on yearly models. Similar Bodine machines (case histories on request) process the motor pole pieces, commutators, gear housings and end plates . . . Bodine speed and low-cost efficiency ALL the way.

PRODUCTION on this machine, with its specially designed electronic programming motor on the main drive to cut every second of idle time, is 675 pieces per 50-minute hour.

If you have a production job on which you, too, want to aim for an entirely new standard of cost-quality-volume efficiency, send drawings and samples to Bodine. Write Dept. AM-5.

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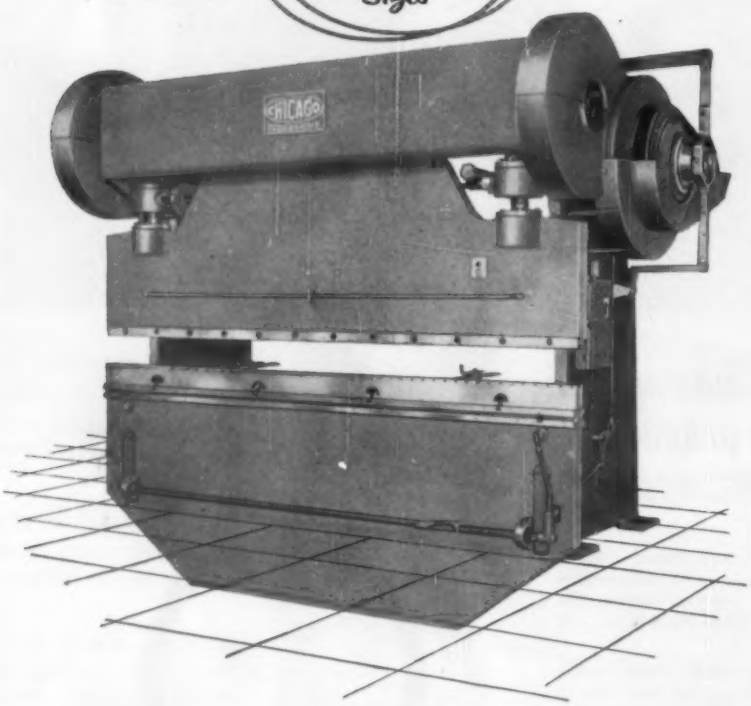

This is one of the Series D CHICAGO press brakes. It has a bending capacity of 10 feet by ¼ inch—150 tons. Over-all bending length is 12′-2″.

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seen that when a man's nervous system has been damaged the functioning of his operating faculties has been greatly impaired. Dr McCartney goes on to say that noise clouds judgment and reduces the precision of our actions.

What other element of manufacturing requires greater judgment than the operation of a machine that is noted to sneak up on the worker when his vigil is momentarily relaxed? Precision of action cannot be maintained if the worker has to carry on with "noisy noises."

I venture to say that the press of urgent production does not permit Ed to evaluate the sincerity of Ritter's complaint and he brushes it off as being a case of habitual gripes instead of a serious emotional condition.

The doctor goes on to say that "The worker's analysis of objectionable, noisy environment can be summarized as follows:

1. "No one minds his own noise—it's the commotion caused by the 'other fellow' that is annoying.

2. "Sounds that 'crowd' in on him from unrecognized or not easily located sources make him nervous or jittery.

3. "Intermittent sounds, noises cutting in and out of the over-all level at unexpected times, are worse than continuous sounds."

From the foregoing it can readily be seen that to tie the can to Ritter's tail and send him out of the plant would be a grave injustice to the man. The fault does not lie in the worker but in the condition under which the worker has to suffer. Another man would probably

"I'll whistle when I want you!"

not be so sensitive to unusual noises but it is not up to the employer to try to equip his plant with supermen; his duty is to establish working conditions suitable to the average. It would be asking too much of him to make working conditions conformable to the emotional setup of the highly temperamental whose nerves are, by some imposed gift of Nature, too highly strung for him to become a comfortable worker in noisy industry.

"The worker judges a sound to be loud only as it is related to the foregoing factors" says Dr McCartney. "He's not particularly interested in decibels—he is interested primarily in freedom from annoyances and distraction."

Incidentally, there is an article in Fortune magazine of October 1955, entitled "The News About Noise" by Francis Bello, in which he advocates the use of ear plugs for the worker who wishes to maintain his emotional stability and industrial tranquility. Not a bad idea, but they would have their disadvantages in that more noise would be necessary for the foremen to make his orders known. All men would not wear them as is evidenced by the lack of proper goggles to protect one's eyes. Some smart alecks look with disdain upon anything promoted for their safety.

Cannot resist concluding this article with the old one about the emotionally distracted mollusk: "What kind of a noise annoys an oyster? A noisy noise annoys an oyster." So, Mr Foreman, take a look around your punch press department and see if you cannot improve conditions relative to unnecessary noises and you'll find that your happy oysters will reward you with valuable pearls in the way of increased production.

Robert Roundbottom
Laguna Beach, Calif.

WE ARE all inclined to get in a rut of some kind or another and I am of the opinion that Ed's Nemesis, Ritter, plunged into his and became satisfied with the noise of his own machine. My heart goes out to the poor sucker who has to spend his days in a press-room with all its nerve-wracking noises and the many dangers therein. I feel that the greatest advancement that can prevail in the manufacturing

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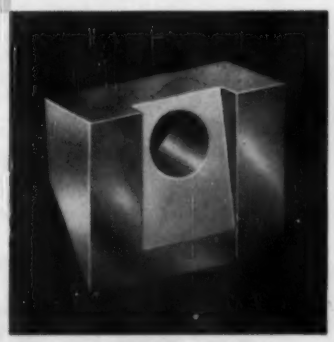

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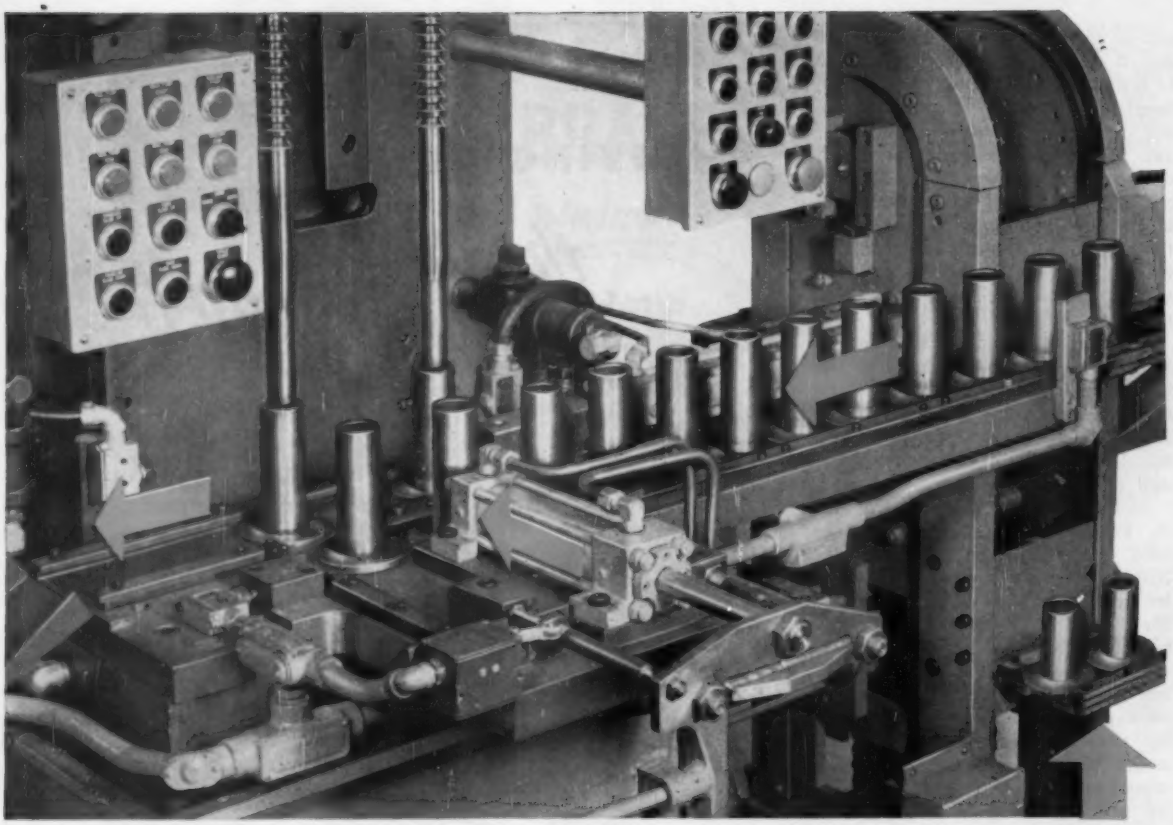

STANDARD Broaching Machine Tooled for AUTOMATION

This broaching setup on a Detroit 15-ton, 42-inch Vertical Pull Down Machine illustrates *practical* automation! It combines the economy of a standard machine, readily retooled for production changes, with a special work handling system that makes floor-to-floor operation fully automatic.

Flanged work pieces are loaded at floor level, conveyed to an elevator, raised, pushed off and shuttled into broaching position, broached and unloaded . . . all without an operator. Each broaching stroke sizes the I.D. and removes excess welding at the flange joint. Parts are handled as fast as they can be supplied by the "automatics" ahead of this operation.

The same broaching specialists who created this productive combination of "standard and special" can help solve *your* production problem. Send parts, prints or details now.

Write for bulletin describing Detroit Vertical Pull Down Machines.

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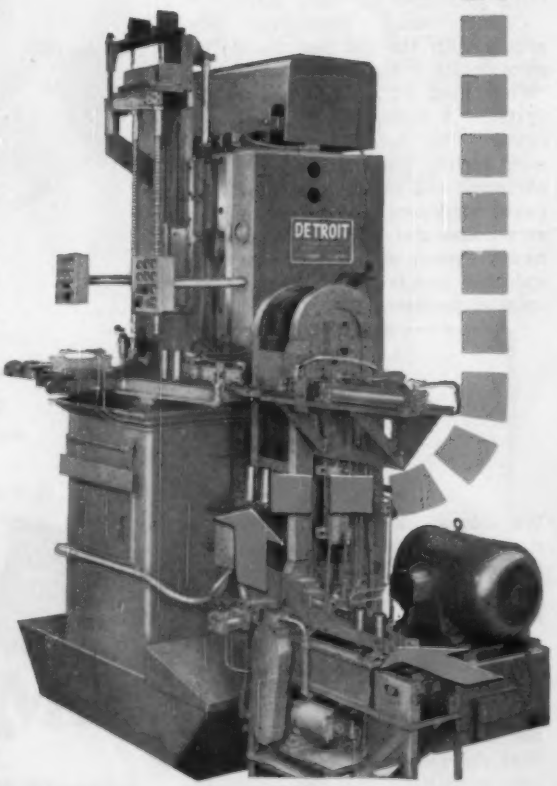


industry will be the elimination of unnecessary noises.

When we accustom our bodies to certain so-called irregularities and suddenly expose them to something entirely different there is hell to pay with our nervous system to such an extent that the peaceful functioning of bodily activities goes completely haywire.

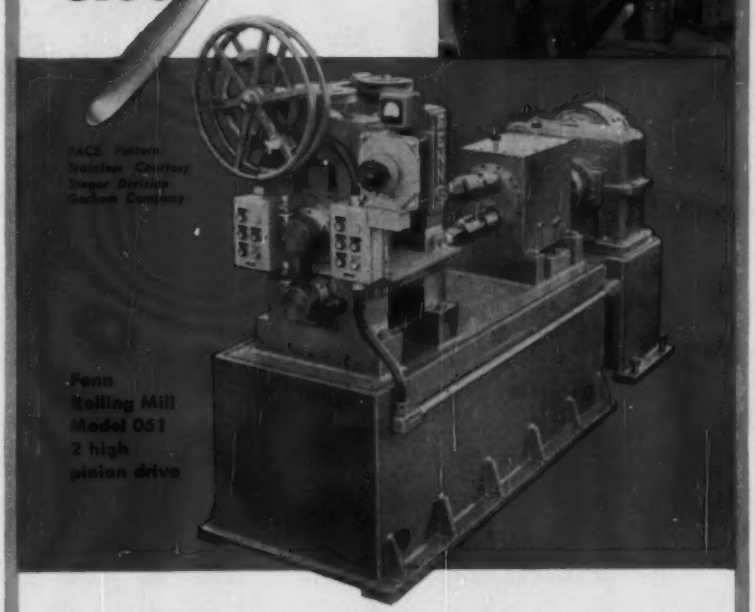
There are many situations which accentuate the effect that unusual noises have on the hearers. Recently I turned on my television (oh yes, I live up to the hilt!) to enjoy a good fight and, having accustomed myself to the regular announcer's voice, I was all set for a thrilling ten rounds. The announcer on deck raised his right hand and proceeded to blast my delicate ear drums with his high-pitched yet eloquent voice. I cannot explain the effect this had on me, but suffice it to say that had I been put in the ring right then I would have, according to my feelings, floored the contestants and the announcer with the greatest of ease.

So I have every reason to believe that jittery Ritter had some justification for his objections to having to endure the additional staccato incursions of the newly installed machine. If we had more Ritters and fewer Stevensons maybe something constructive would be accomplished in the manufacturing world.

It is just too bad, Ritter, that you find yourself in the fix you do. Damn the torpedoes; full speed ahead, said some brilliant mind of the past. Damn the unnecessary noises made by modern machinery, and plug your ears to them because progress must go on while Ed and

"So help me, Harry, winning all that money on that big quiz program hasn't changed me a bit!"

a pinch that pays on stainless steel



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Fenn Rolling Mill Model 051 2 high pinion drive

FENN ROLLING MILLS, because of their flexibility and dependability, have been adopted as standard mills in many vertical segments of the metal working industry. In the manufacture of flatware, for example, Fenn rolling mills are in use by nearly every major producer. These mills are specifically designed to meet the flatware manufacturers' precision requirements for grading, pinch rolling and cross rolling.

The Fenn Model 051 mill, shown above, is in operation at the Stegor Division, The Gorham Company, Providence, R. I. In a two-pass operation, .095 ga. tableware blanks of 430 stainless steel are pinch rolled with .027" reduction taken on the first pass, and .013" reduction on the second. Production rate is more than 200 pieces per hour with dimensional tolerances held to ±.001".

For complete information on Fenn Rolling Mills write for Catalog RM 56 or, better still, let Fenn engineering service study your requirements for specific recommendations.

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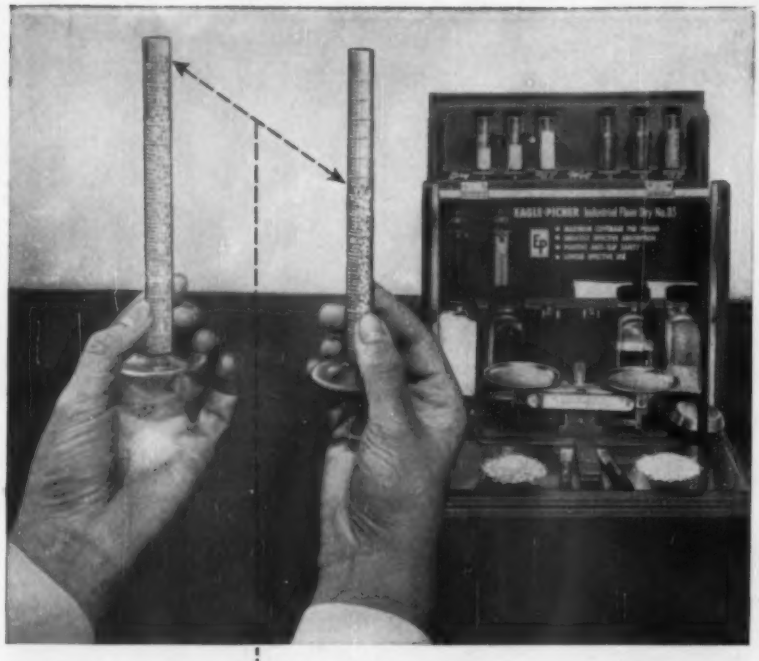

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WRITE TODAY. Our Eagle-Picher representative will bring the portable laboratory to your office where you may make this test yourself. The Eagle-Picher Company, Cincinnati 1, Ohio.

Al figure some way out to calm the waves of aggravation. Look upon this machine as speaking a different language and strive to learn its meanings. If you have too much trouble, drop in at Joe's and have a fill of quadruple XXX and then go home and sleep it off. On the morrow as you start to work on the old kerpalump you'll find the accompanying, harmonizing blimp-blimp-blimp as an incentive to dive in for higher stakes in production. If that fails, just resort to some good ear plugs between the hours of eight to five. Outside of that, Ritter, keep up the gripes, for sure as hell something will come of it one way or another, and a new job isn't such a bad thing after all.

J Homewood
Laguna Beach, Calif.

VACATION RIGHTS

Should employees be required to work a full year before they're eligible for a vacation? Would it be practical to allow them to take it in separate days as they become eligible month by month?

AL IS CORRECT when he says something should be done about vacation rights. It isn't fair that a man should lose his vacation because he left his old job in the summer. If anybody leaves his job with risk of losing his vacation, there is probably a good reason for his decision.

Jorgenson is also right when he points out that in Sweden we have a system where each worker gets his regular vacation regardless of how long he's worked at any particular plant, if he's worked at least 16 days each month. We have a nation-wide vacation plan where all employers participate to give all

"Your little woman puttin' on a little weight, Colby?"

employees their vacation rights. These rights are at the present time regulated by a law passed by our Riksdag in 1946 superseding an older law of 1938. But even before the law of 1938, there were certain vacation rights included in prevailing contracts between unions and employers.

The most important stipulation in the current law is that every man who has qualified for his vacation rights the previous year, or worked 12 months, say from June 1 the year before vacation until the 31st of May the same year the vacation period occurs, has the right to 1½ workdays' vacation per month with full pay, which is figured on his average hourly wage the previous year or part thereof that he has worked for his present employer. This means that he is entitled to a maximum vacation period of 18 workdays.

Should a man work only 15 days a certain month he will lose his vacation rights for that month, and he cannot make up for it the following months of the year. But if he can present a doctor's certificate that he was sick part of the month —in this case only one day—he is entitled to his regular vacation for that month. Should he stay sick a long time he has still his right of 1½ workdays per month up to 90 days. If a man has been hurt while working for his employer, there is no limit set for his vacation rights. If he is called out for military service up to 60 days, he won't lose any of his vacation either. A woman who is going to have a baby may stay away from her work up to 12 weeks without losing her vacation.

Now if a man works for instance only 4 months at a certain place and then leaves to get a job somewhere else his vacation right is payed off for the 4 months worked, and his next employer need give him vacation pay only for the 8 months left of the year—if the man stays with him until vacation time next summer. If he doesn't, the new employer also pays him off for the number of months worked, should he leave ahead of the vacation period.

Abuses? Of course; so it is with any privilege, but in the main this system works very well. Sometimes men leave to get payed off so they can use their vacation rights many months before vacation time. This could be due to illness in the family, when they might need this money,

(Continued on page 250)

eliminate production operations . . .

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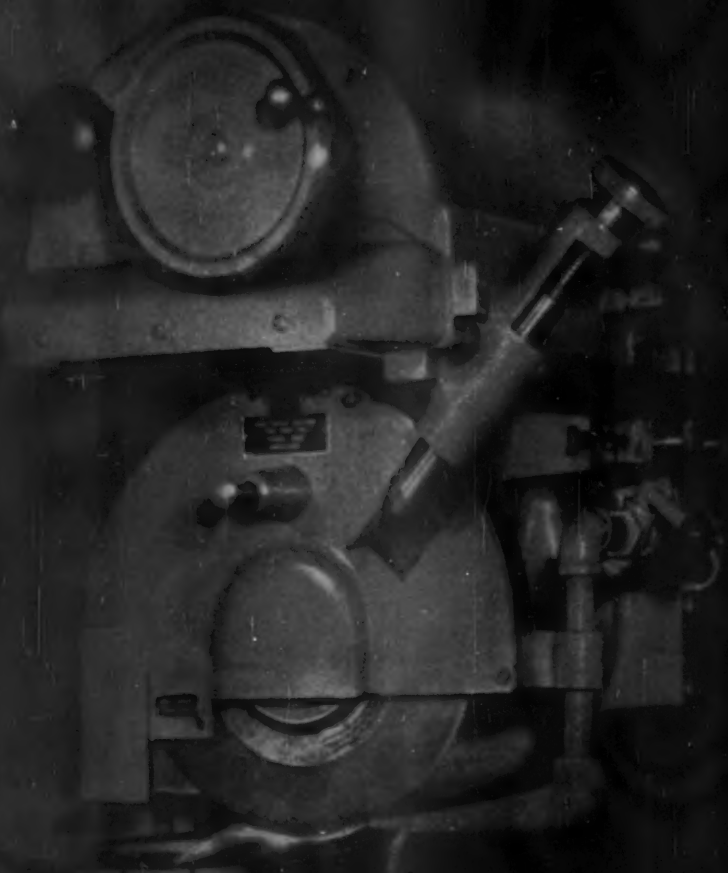

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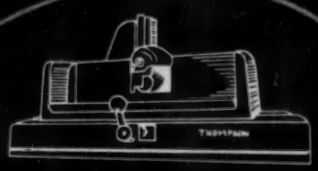

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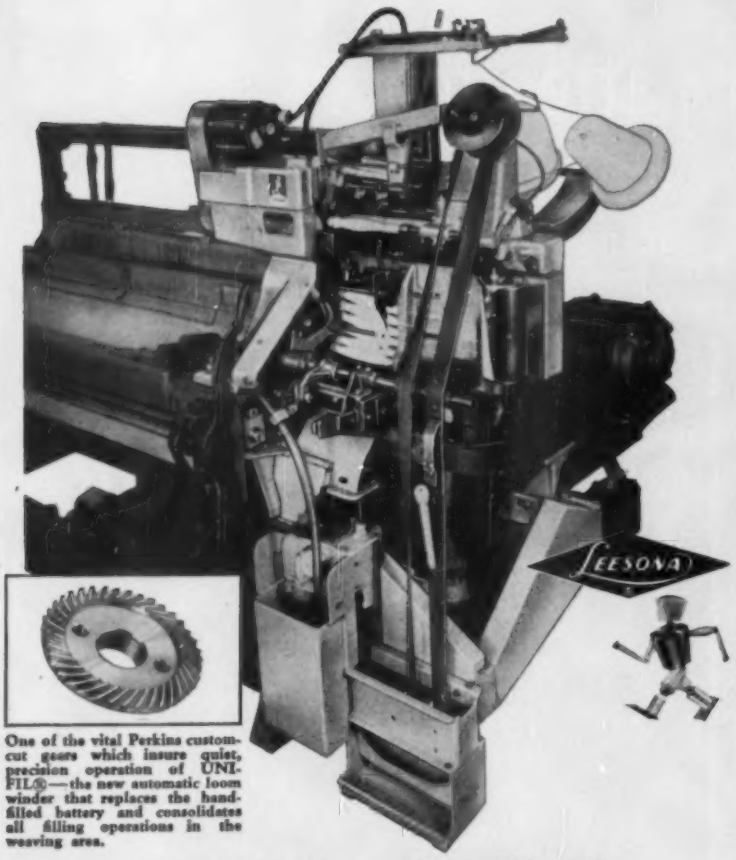

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but often I am afraid the money is spent foolishly. When vacation time comes they have already used up their vacation rights, and if the shop closes down during the period, they also lose their ordinary pay for that time.

One paragraph in this law says that vacation should be used for recreation purposes only. If a man is found working in his trade at some other plant which is running, his ordinary employer who gave him his vacation money, can demand that money back.

Al's suggestion to Ed to phone the man's last boss to find out about his vacation rights would involve too much trouble and too much uncertainty. And for the present employer to give a few extra vacations would cost a considerable amount of money, which would be abused more than when fast rules are agreed upon to be practiced all over the country.

I agree with Ed that if the new men get vacation at company expense, the old timers would have a good reason to complain. It would not be fair to them. New employees should not have equal rights to vacation in Ed's and Al's shop unless they stick out a waiting period as the others have done. On the other hand, it is unfair to a man to lose his vacation rights just because he didn't stay with his previous employer the whole year through. The way to avoid such unfair treatment is to adopt the Swedish or similar system, which is a guarantee to every man's vacation rights if he qualifies by putting in enough time

"I was having a swell day at the plant—and I couldn't understand it. Then I realized I was in the wrong plant."

the previous year or another 12 months' period before the vacation period starts in the summer.

A E Fristedt
Stockholm-Bromma, Sweden

E W Howe once said that "financial sense is knowing that certain men will promise to do certain things, and fail."

If it is true that some men fail to fulfill their promises then how can employers expect to extract a year's work out of a new employee who isn't even under contract? If a fellow does not put in a year's work it follows then that he is not entitled to a vacation.

If the above reasoning be true, and a company follows the policy of giving vacations at the start of employment, it would not be illogical to first send a man his vacation pay, the acceptance of which would be followed by his notice of resignation.

This could certainly be a profitable source of income for people who found it preferable to spend the hours between eight and four relaxing in the sun 'n surf. It is not unreasonable then to ask a man to precede a vacation by twelve months' earnings.

Neal A Mack
Belle Harbor, NY

PEACHES AND CREAM

Would a worker appreciate a birthday or "get well" card sent to his home by the company? Or would he be more inclined to look on such a thing as foolishness, and prefer to be remembered in a more practical way?

Peaches and cream are a treat only if our thirst has been quenched, and our need for the entree has been filled. If any of the aforementioned ingredients for a good meal are missing, the dessert cannot be appreciated.

But if a man receives just compensation for his services, a personal message in the form of a birthday greeting is a thoughtful gesture. However, a card is merely an attempt to personalize relations between employer and employee. Various companies have found that this can be done in several other ways that serve a more practical

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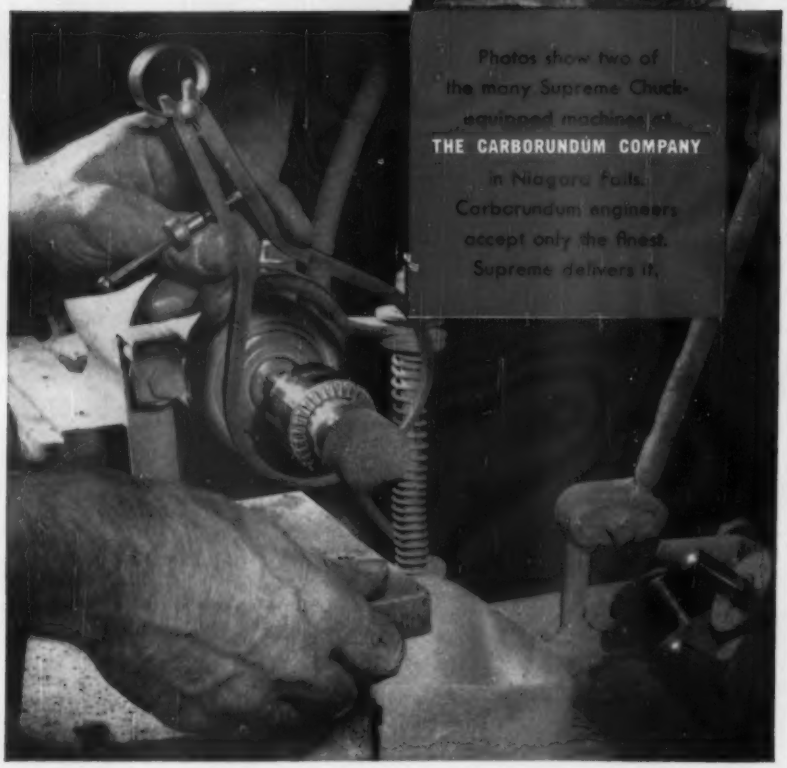

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Supreme Chucks BRAND up front on America's leading power tools

SUPREME PRODUCTS CORPORATION • 2222 S. CALUMET AVE., CHICAGO 16, ILL.

purpose. For a number of years the Radiomarine Corp of America has made it practice to serve tea in the afternoon without having a man leave his desk. I have found that the workers appreciate this consideration on the part of management. Another common custom that has created goodwill is the distribution of turkeys at Thanksgiving and Christmas. It has made the individual feel that he is more than just another cog in the wheel.

Provided that supervision has fulfilled its most important obligations, a just wage and good working conditions, the trimmings on the cake are accepted warmly.

Raymond Geraghty
Brooklyn, NY

EVERYTHING has a time and place, therefore sentiment falls in line. An anniversary or birthday card coming from the man in charge of a plant, a person the worker hardly knows by sight, is pretty meaningless. In a greeting card we look for the personal touch. The care necessary for such a choice would be time-consuming and costly. Therefore a uniform message would have to be sent. This would mean a little more to a worker than a greeting that he receives over the radio from the sponsor of any one of the products he uses.

The men would probably be more appreciative if the peaches-and-cream fund was contributed to a worthy charity in their name. As it is better to give than to receive, the satisfaction that ensues from the knowledge of such a donation

(Continued on page 256)

"Honorable Company send Wong Lee as replacement until technicians able to repair digital computer machine!"

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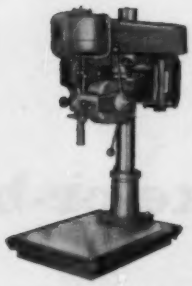

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Pittsburgh 8, Pa.

☐ Please send name of my W-T distributor.
☐ Please send literature.

Name_____
Address_____
City_____ Zone_____ State_____

How to win a make-or-buy

for production men

This Avey machine is used in a jet aircraft plant on the West Coast for drilling, boring, and spotfacing the flanges and periphery of a jet engine component.

The two Aveydraulic units mounted horizontally have 12″ ram travel. The third Aveydraulic unit, mounted vertically, has 16″ ram travel and a 6-speed gear box with a speed range of 150 to 1800 rpm. The vertical column has an in and out traverse of 20″; moves to a minimum of 15″ and a maximum bolt circle of 55″.

The 60″ Electrodex table is equipped with a master index ring with two rows of bushings, 96, 49, and 8 indexes respectively. The three heads can be programmed to the indexing of the table.

Another example of how Avey combines standard units to meet special production requirements.

for management

Make-or-buy decisions are frequently close. Some of the questions you must ask yourself are:

If we decide to make . . .

What about indirect labor, plant space, supervisory time, and other overhead? Will we be merely spreading our overhead over a larger base? Or will we be increasing it?

If we decide to buy . . .

Can our suppliers make a reasonable profit at a price that's right for us?

Whichever way you go, Avey production machines can help.

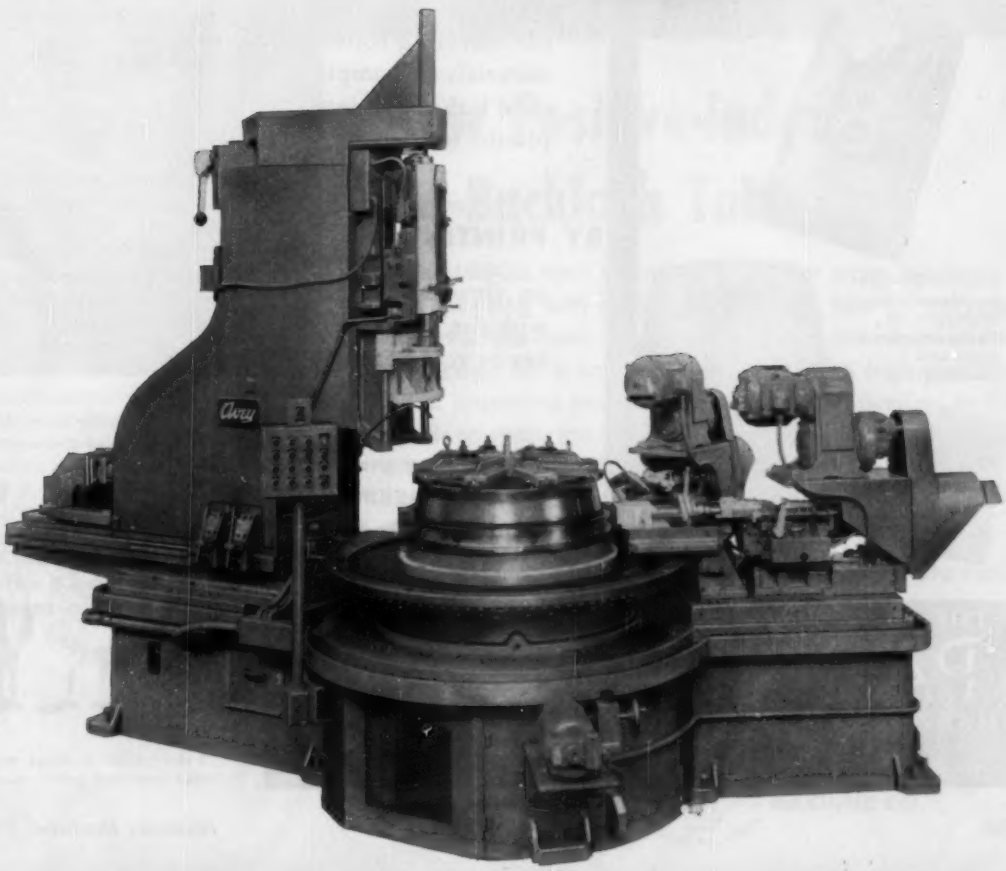
Put their high productivity in your plant, and their high earning rate will quickly justify your "make" decision. On the other hand, if your supplier is equipped with Avey machines, the chances are good that you can buy at a low unit cost and still feel comfortable about his profits.

THE AVEY DRILLING MACHINE CO., CINCINNATI 1, OHIO

drilling, tapping, production machines

decision

Avey

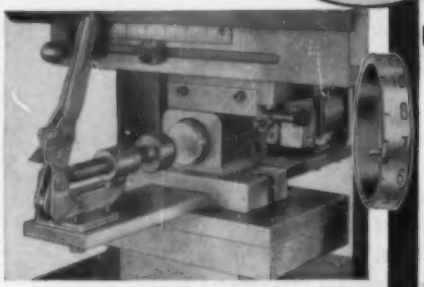


MARK *Your* PRODUCT FOR *More Sales!*

for identity, for product recognition

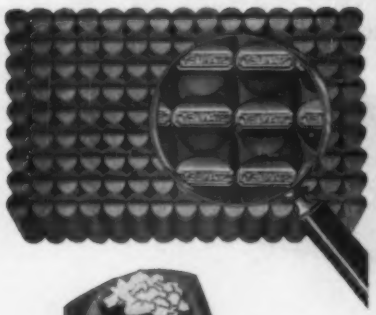
BY HAND...

handstamp trade marks, legends on short run components.



BY MACHINE...

automation in marking on production runs, manually, hydraulically or by air.



BY PRESS...

for metal, wood or plastic products with standard or special marking dies.

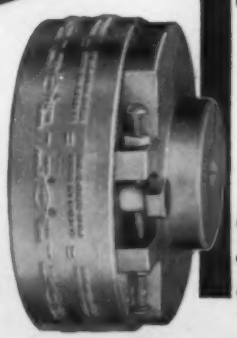
BY HOT STAMPING...

for indenting softer materials or stamping gold leaf or foil into plastic, leather, etc.

BY PRINTING...

on virtually any surface with flat, concave, convex or roll printing dies.

Send for folders and descriptive literature on Parker marking tools and machinery.



Give your product the mark of quality with... MARKING TOOLS & MACHINERY by Parker!

THE PARKER-HARTFORD CORPORATION
MARKING DIE & MACHINERY DIV.
FRANKLIN AVENUE • HARTFORD, CONNECTICUT
by Parker

would be more pleasing than an attempt to mass produce something that is limited by its very minuteness.

Peaches and cream have their place as long as they're not mishandled in such a manner that the peaches sour and the cream curdles.

Catherine McLaughlin
Rockaway Beach, NY

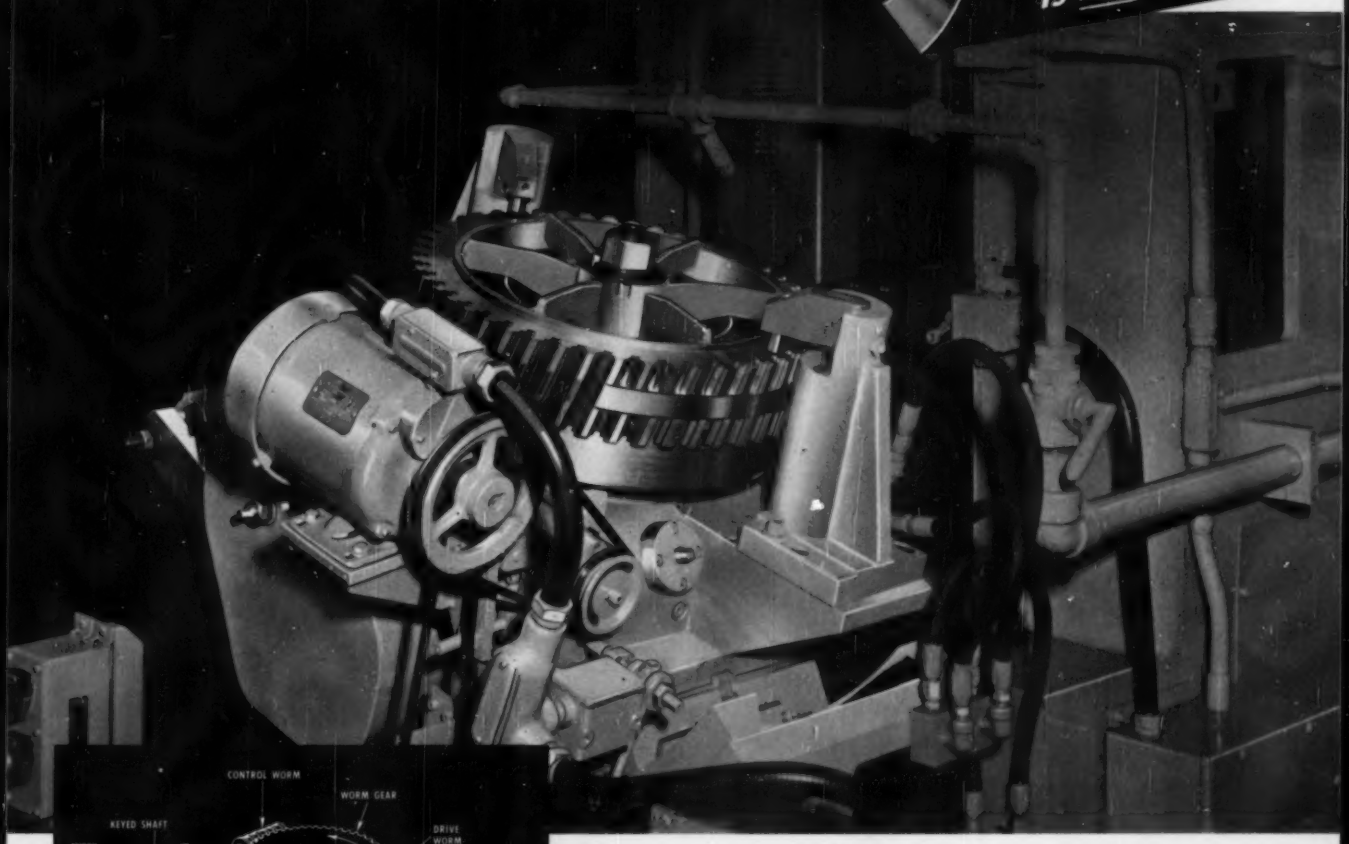
SENDING cards to the employees on their birthdays and wedding anniversaries is an excellent method of building that all-important and valuable quality, good will.

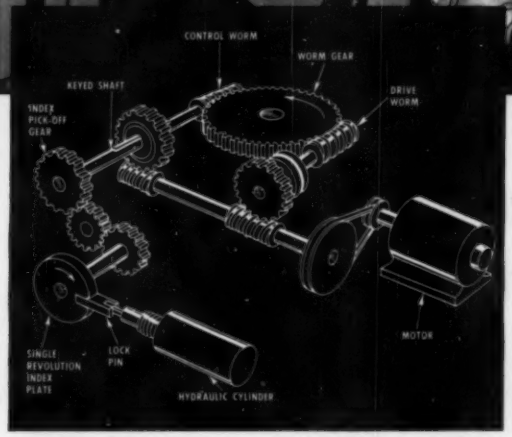
The industrial plant and the shop are becoming more impersonal with each passing year. Increased specialization and greater sub-division of the work is the order of the day. The goal is increased efficiency and production, but the cost is loss of personal contact between the worker and his employer and also between the worker and the finished product. In many plants the employees receive their instructions and job orders in written or printed form and there is little personal contact between people on different levels. Such an environment emphasizes the separation and is not conducive to the growth of good relations. Left to themselves the employees' feelings will grow away from the company and they will find solace and comradeship in each other by viewing the company and its management as common enemies. A mutual feeling of hatred provides a strong bond.

Company-sponsored programs to disseminate information about the company, its history, its hopes and its goals are becoming widespread. These programs have proven themselves a valuable tool for improving employee loyalty. The employees are happier when they feel that

"I don't want to argue any more—I can tell when you start gettin' mad."

WITH COLONIALS the final cost is less!





Indexing is controlled from a positive pin locked single-revolution index plate. A variable-index gear train connects the plate to the control worm through a keyed shaft. Rotation occurs only during index when the opposed control worm allows the drive worm to move. A continuously running motor does double duty; it provides the indexing power . . . and takes up all backlash in the unit through two slip-type clutches. All gears lock when the index pin locates into the plate. The table index can be from 21 to 250 divisions of a circle depending on pick-off gears used.

New Positive-Index No-Backlash Table*

COLONIAL now offers truly positive parts positioning and indexing with no backlash at any time . . . works on most machine tools . . . already used in jet engine plants (turn page for a striking example) solving high precision index broaching problems. Fast, versatile, precise. And it stands up under the toughest service. Available in standard diameters of 11, 18 and 28 inches. Can be mounted on either horizontal or vertical cradles. Special diameters and sizes can be supplied to suit application.

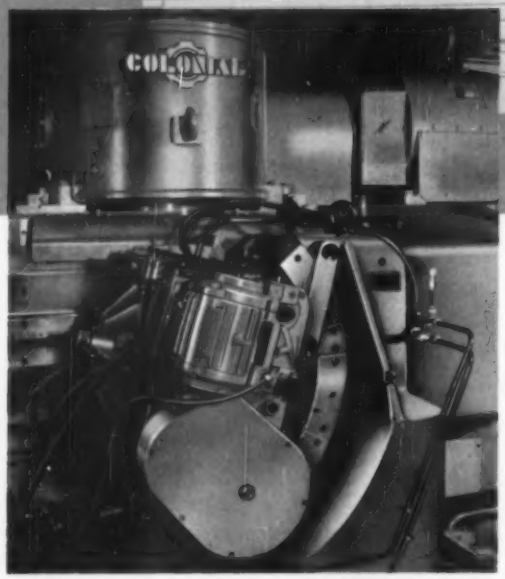
Write today for Bulletin JF-57 giving complete data.

COLONIAL BROACH & MACHINE CO.
DETROIT 13, MICH.

PATENTED

WITH COLONIALS the final cost is less!

38.5 sec's cycle time per slot



COLONIAL new positive-index no-backlash table is used by Ford on the machines which broach the dovetail slots of sixteen different compressor rings. With this equipment Ford gets longer tool life, better finish, and index precision measured in tenths. For this application, the universal table is set for a 28-position index (for fixture details see reverse page). Operation here is: shuttle in; broach at 30 fpm; shuttle out; index (2 seconds). Broach returns (200 fpm); shuttle in; etc.

How to Broach Tough Materials Fast

Compressor disks for Ford J-57 jet engines are of tough stainless steel or titanium . . . yet call for close tolerances in machining and index. This battery of a 180-inch stroke COLONIAL ElectroGear-drive machines is used to produce all sixteen types of disks used by Ford. Average time per slot—including indexing—is less than 40 seconds.

For the newest ideas in broaching make sure you get BROACHING NEWS regularly. Let us know if you are not on the list.

COLONIAL
BROACH & MACHINE CO.
DETROIT 13, MICH.

they are part of the team. Good employee relations, like good health, is a fleeting thing that declines when constant care is not rendered. Congratulatory cards provide a good way to nourish the growth of these feelings toward the company.

To the average household the plant, or the shop, is the place where the bread-winner earns a livelihood. To them the plant is not a place vibrant with men and machines, it is just a building. It is the place where the husband or father works. They may know his title, but they know little of what he does and, not having a basis for good feelings, their attitude toward the plant management is one of animosity shrouded in mystery. Greeting cards and little gifts sent directly to the home provide an all important pathway to the employee's family. It provides an inexpensive way to implant a lot of friendly feelings at the place where they will do the most good. A good word about the company from a member of his family will have a very desirable effect on the attitude of an employee.

Congratulatory cards represent a big step in the right direction and it is an idea which should be continued and extended.

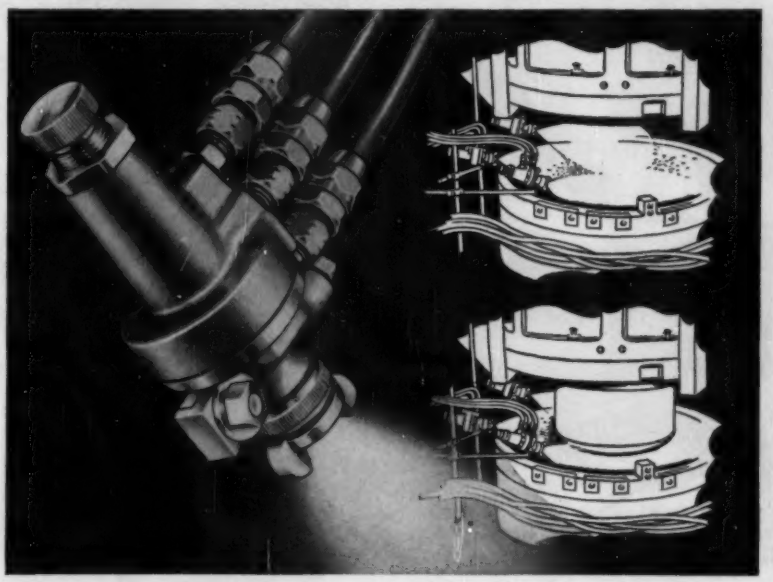
William Martin
Brooklyn, NY

WE ARE *all* aware of the fact that business is conducted primarily for profit. Of those who are narrow minded enough to consider profits as coming from workers who feel compelled to put in time so as to draw their pay we must conclude that they have warped ideas as to what constitutes effective production procedure. To the boss who looks upon his workers as human beings, and who takes into consideration the potentiality of a satisfied employee, we have to give credit for having the power of effective thinking.

Any man, if he is at all normal, appreciates a slap on the back at intervals. Whether this touch of acknowledgment comes in the figurative or literal makes no difference; it is a recognition of his efforts and effects a desire to reciprocate in the form of greater application and cooperation. Patterson of National Cash Register fame, one of the greatest of industrial leaders who made no move without considering the effect upon his workers, based the

Automatically sprayed-on drawing compounds cut metal-forming costs

NEW DEVILBISS METHOD SAVES COMPOUND, COATS EVERY PART EXACTLY ALIKE, IS FULLY AUTOMATIC



Split-second timing. *DeVilbiss WDB automatic guns spray exact amounts of drawing compound evenly over specific areas of die, as it opens and closes. To synchronize spray with press cycle, cam-actuated air valve is worked off the ram. In other instances, a solenoid air valve is actuated by chain-drive timer, operating off gear wheel.*

Now you can cut stamping costs, increase production rates, get uniform application of drawing compound in your production of stamped or formed metals. DeVilbiss spray method and versatile spray guns eliminate wasteful swabbing, rolling, or dripping lubricants – save you time and money!

DeVilbiss WDB Gun is designed and built specially for applying die lubricants. It is compact, durable; sprays all types of compounds – from the lightest oil to the thickest creamy or foamed materials. Spray pattern is completely adjustable, from a fine round shape for narrow stock, to a broad fan for wide surfaces. The gun is built to maintain precise, constant rate of application; is easy to install, and offers low maintenance.

For full details, see your nearest supplier today; or write us direct. *The DeVilbiss Company, Toledo 1, Ohio.*

FOR BETTER SERVICE, BUY
DEVILBISS

DEVILBISS HELPS YOU GET THE MOST FROM THE SPRAY METHOD

Locate your Plant among

Happy People

for increased production

Really live while working

in the **TEXAS BRIGHT SPOT**

The "Texas Bright Spot" has all facilities necessary to serve and support new industry . . . water, labor, market, transportation and graduate studies for technical personnel.

And, besides — for fun and relaxation, more than 90 lakes within an hour's drive for fishing, boating, swimming, picnics, etc.

Check these Advantages:

- Center of $27 billion market
- Excellent rail and truck services
- No sales tax, no state income tax
- Room to grow
- Ample electric power
- Friendly, Texas workers
- Cooperative city, state officials

Write us for information on how we can supply your requirements.

Texas Power & Light Company

AREA DEVELOPMENT DIVISION

Fidelity Union Life Building — Dallas, Texas

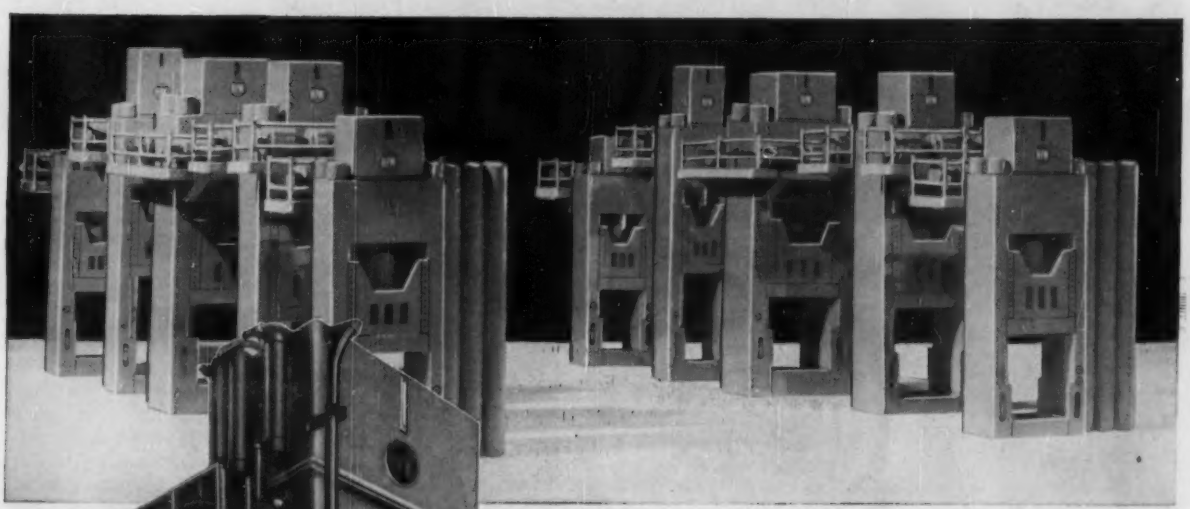
success of his efforts on the quality of his product plus the tranquility of the workers who produced that product. He saw the profitable value of a contented worker and did everything in his power to make him a healthy, happy working unit. Patterson took means to protect the worker's health by—to cite one instance—enabling the employee to check out an umbrella in the event of an unexpected rainstorm. No doubt he would have had each of his employees sent greeting cards on birthdays were he living today.

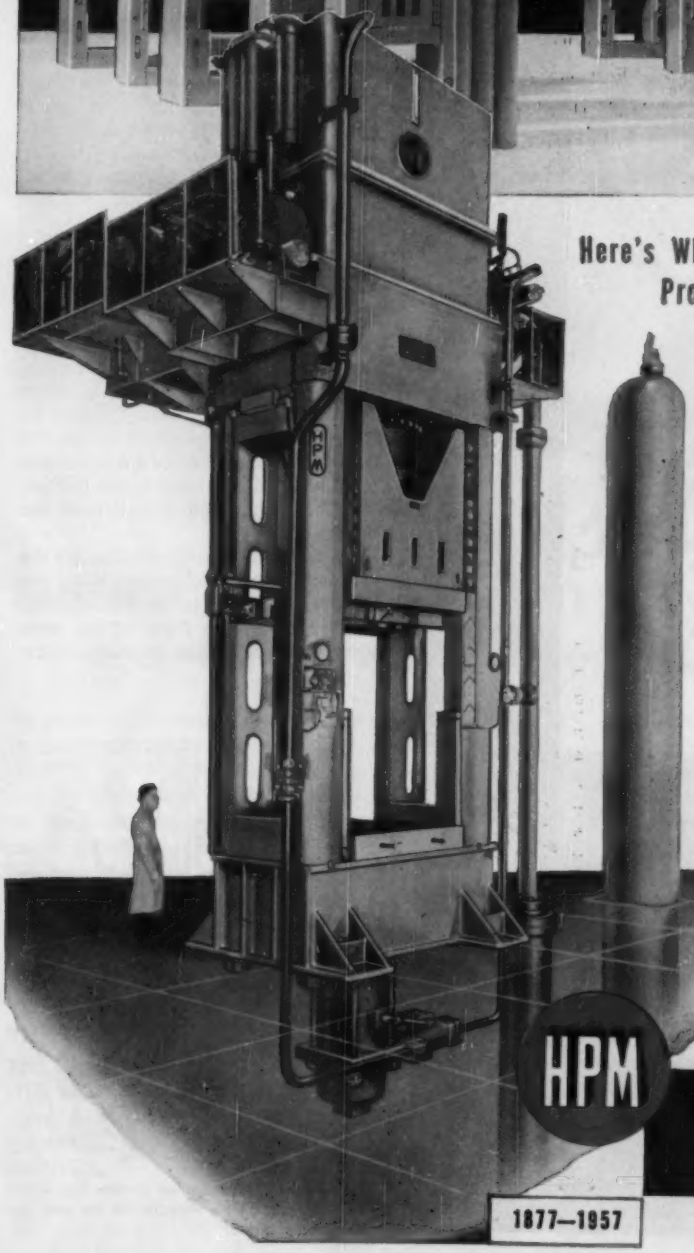
We think nothing of spending thousands of dollars in advertising, yet there are some who find fault with the idea of spending a small sum for the purpose of remembering birthdays of the workers who produce the product. I agree that this greeting card practice has gotten out of hand in a way, but for the purpose of maintaining harmonious relations in the plant I see no reason why it isn't a good idea. I do object, however, to sending birthday cards to the workers' wives. To my way of thinking this is a source of trouble for the poor sucker who either neglects the occasion or, possibly, has no truck with the idea of sending cards.

Doesn't Ed know that by making the worker happy he is making money the easy way? You can run a business more effectively by having contented employees than to have workers who feel that they are merely cogs in a machine. Contentment is the backbone of good relationship between the worker and his boss and one of the ways to gain contentment is by paying

"I'm tired of no clean rags."

IT'S A MATTER OF EXPERIENCE . . .





Here's Why More H-P-Ms are Chosen for Shell Production than any other make of Press

H-P-M high explosive shell production know-how has been invaluable through three major emergencies and our preparedness program. Here's the proof ...the above photo shows models of H-P-M presses for two shell lines which will produce 8 inch high explosive shells at a large midwestern plant. And a line of five similar presses has been installed at another plant for the same job. These are the only two major facility contracts placed for shells in the past two years. The presses, tooling and engineering planning are H-P-M standards—standards that the Ordnance Industry team accepts with complete confidence assured through hundreds of successful installations.

Shell manufacture is only one of the important jobs for which H-P-M presses are so widely accepted throughout the metalworking industry. If you have a problem concerned with the forming of metal, complete H-P-M engineering service is available for planning and follow through. For complete information, write or call us today.

The H-P-M 1000-ton press used in hot piercing high explosive 8 inch shells, the first operation in the hot forging, cold extrusion process used in shell manufacture.

HPM

THE HYDRAULIC PRESS MFG. CO.

Mount Gilead, Ohio, U.S.A.

A DIVISION OF KOEHRING COMPANY

1877—1957

1957 Design Engineering Show
New York Coliseum May 20 to 23

booth #405, at the show,
see another of the world's finest line of expanders in operation

GROTNES No. 16-IV-660 HYDRAULIC EXPANDER for sizing and forming round and polysided ports. Capable of expanding 12.3 Sq. In. of metal having a yield strength of 100,000 psi. This machine is similar to the one that will be at the Show, and is typical of Grotnes Hydraulic Expanders. Tonnages from 25 to 1600 (Drawbar Pull).

SEE MODELS — GET DATA ON THESE GROTNES MACHINES, TOO

- SHRINKERS
- WELD ROLLERS
- WELD TRIMMERS
- RIM (PROFILE) ROLLERS
- MECHANICAL RIM EXPANDERS
- PAIL MAKING MACHINERY
- DRUM MAKING MACHINERY
- COILERS

GROTNES MACHINE WORKS, INC.

attention to the little things that open his eyes to the fact that his boss is a human being after all, in spite of the cloudy frowns ornamenting the top-dog's brow most of the time.

Rex Warren
Waterloo, Iowa

DEVELOPMENT CORNER

If a shop wants to experiment in development work, how should it be handled? Should an independent department be set up? Is it fair to take a man away from a foreman to work on development, without replacing him?

THE BEST SOLUTION to Ed's problem is the establishment of a separate department for experimental and development work. Such a move would be beneficial to Ed and the men in his department and to the company in general.

It is a poor policy to have one of Ed's men working in his department and on his budget but relieved of Ed's jurisdiction. Such an arrangement weakens Ed's authority and his position in general. The longer Hanson works on these development projects the more difficult it will be for him and Ed to re-establish the former arrangement of foreman and mechanic. Going back to his old job will be in essence a demotion for Hanson.

Ed as foreman certainly knows the importance of development work but he does not like to have it demonstrated to him in front of his men. Each supervisor and employee likes

"I know the union got us a raise last month . . . so this month thought I'd try and get one all by myself!"

Here's how Bearings, Inc. helped a customer save $2,000 in 60 days!

By removing bearing inventories from several departments to one centrally located stockroom, establishing records showing every application for every bearing, the bin number where these bearings are stocked and the quantity on hand, our engineers saved our customer money and made all bearings immediately available. Many identical bearings bought by several departments for many types of machines were found in quantities exceeding normal requirements. Many bearings were unuseable — unwrapped, dirty and rusty. A few of these bearings are shown above with W. J. Lukach, Bearings, Inc. sales engineer who supervised cleaning, greasing and re-wrapping all bearings not in original boxes.

THE PAYOFF OF OUR SERVICE, ACCORDING TO OUR CUSTOMER, EMPIRE STEEL CORPORATION AT MANSFIELD, OHIO, WAS A SAVING ON BEARING PURCHASES OF $2,000 IN LESS THAN TWO MONTHS.

This is not an isolated example of our services — surveys of bearing requirements, inventory control, application engineering, maintenance schedules and procedures are a regular and continuing part of our service to all customers to whom we supply replacement bearings. Ask how we can help YOU!

Providing bearing service in the territories adjacent to our branches, listed below.

BEARINGS, INC.

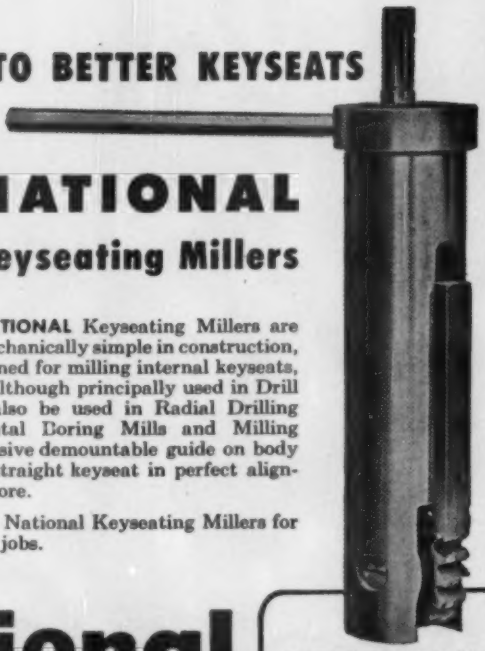
OHIO: Akron • Canton • Cincinnati • Cleveland • Columbus • Dayton • Elyria • Hamilton • Lima • Mansfield • Toledo • Youngstown • Zanesville
INDIANA: Ft. Wayne • Indianapolis • Muncie • Terre Haute
PENNSYLVANIA: Erie • Johnstown • Philadelphia • Pittsburgh • York
WEST VIRGINIA: Charleston • Huntington • Wheeling
NEW JERSEY: Camden • **MARYLAND:** Baltimore
DELAWARE: Wilmington •
Subsidiaries: Balanrol Corp. • Buffalo, N.Y.•
Kentucky Ball and Roller Bearing Co. • Louisville, Ky.

THE KEY TO BETTER KEYSEATS

NATIONAL
Keyseating Millers

NATIONAL Keyseating Millers are mechanically simple in construction, sturdily built, designed for milling internal keyseats, faster and better. Although principally used in Drill Presses they can also be used in Radial Drilling Machines, Horizontal Boring Mills and Milling Machines. An exclusive demountable guide on body of Miller assures a straight keyseat in perfect alignment with axis of bore.

You can depend on National Keyseating Millers for all your keyseating jobs.



national
MACHINE TOOL CO.
CINCINNATI 22, OHIO

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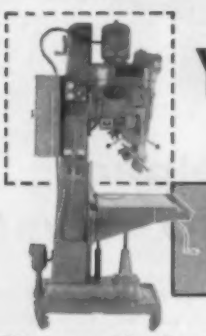
for Catalog No. 17
complete, handy size

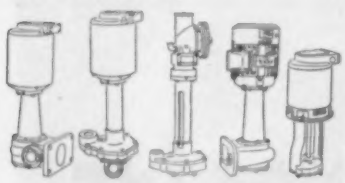


YOU GET BETTER PERFORMANCE
with Ruthman Gusher

This Howe and Fant Turret Drilling Machine is equipped with a Gusher Pump.

COOLANT PUMPS

Gusher Coolant Pumps give you split-second coolant flow from a trickle to full volume. There is no priming necessary, no seals or packing glands. The electronically balanced rotating shaft increases unit life. Maintenance costs are at a minimum. Efficiency in operation is at a maximum.



THERE'S A GUSHER FOR EVERY REQUIREMENT

Write Today for Catalog

Ruthman MACHINERY CO.

- COOLANT PUMPS
- CIRCULATORS • AGITATORS
- MOLTEN METAL PUMPS

1818 Reading Road Cincinnati, Ohio

to feel that his work is essential. This is a healthy attitude and should be encouraged. This feeling will soon be lost if production work is constantly relegated to the background every time the development engineers have a project to be worked on.

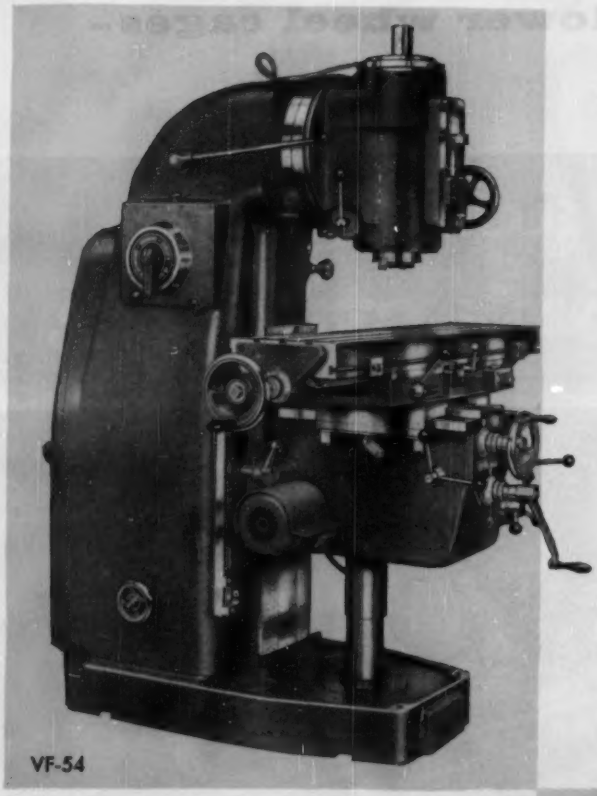
Development work is important and essential for the future and should have its own department even if it starts out with only one or two men. The existence of a development department will serve to remind and encourage thinking of the future. It will solve the immediate problem facing the foreman and may grow into something really important.

People just naturally think in terms of what is available. It does not enter the mind of the methods man to call for abrasive belt finishing if they do not have an abrasive belt unit in the shop. Likewise they do not think in terms of new products and ideas unless there is a development department. A development division serves to stimulate thinking as well as serving to do the actual mechanics of development work. It should be brought to the front and be given the position it deserves and be a step child to production.

Ernest Jones
Bronx, NY

As a company grows bigger, so do its departments. When the firm expands and the product becomes more diversified, the need arises for the so-called special, or development department. Sometimes one or more machines are used within the department. At other times some spot in a corner, away from the regular sec-

(Continued on page 266)



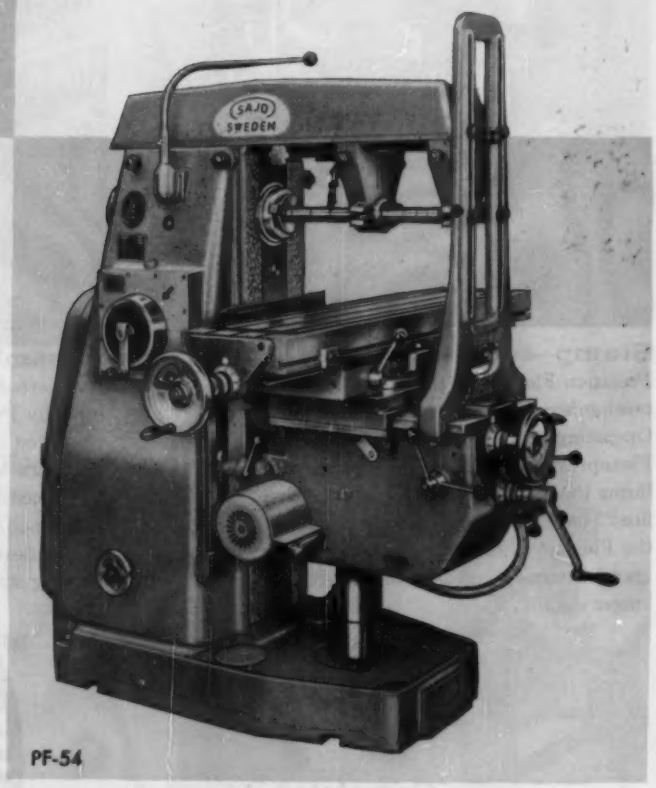
VF-54

ONLY SWEDISH CRAFTSMEN

Can Build These Precision Millers At Such Surprisingly Low Cost

HORIZONTAL AND VERTICAL SAJO MILLERS

Built to U.S. Standards, Sajo Millers with proven production records in modern industry are available in both plain and universal models. Installation references in your vicinity on request.



PF-54

Standard Duty #2 (Model 54)
ALL GEARED Millers—

Plain, Universal and Vertical—table 52" x 11", 7½ HP with power feeds (longitudinal 33½") and power rapid traverse.

•

Light Duty #2 (Model 53)
ALL GEARED Millers—

Plain and Universal—table 41⅜" x 9¼" —3½ HP with power feeds (longitudinal 24½").

Light Duty #2 (Model 48)
Utility Millers—

Plain and Universal—table 41⅜" x 9¼" —3½ HP with power feeds (longitudinal 24½").

austin INDUSTRIAL CORPORATION

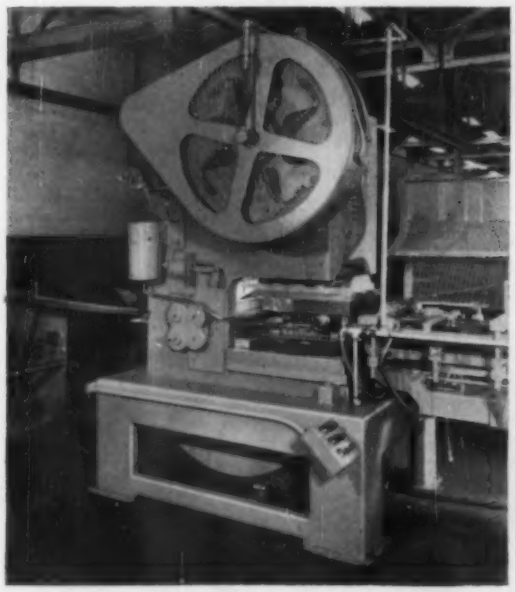
76-F MAMARONECK AVENUE • WHITE PLAINS, NEW YORK

HORIZONTAL AND VERTICAL SHAPERS • POWER HACKSAWS

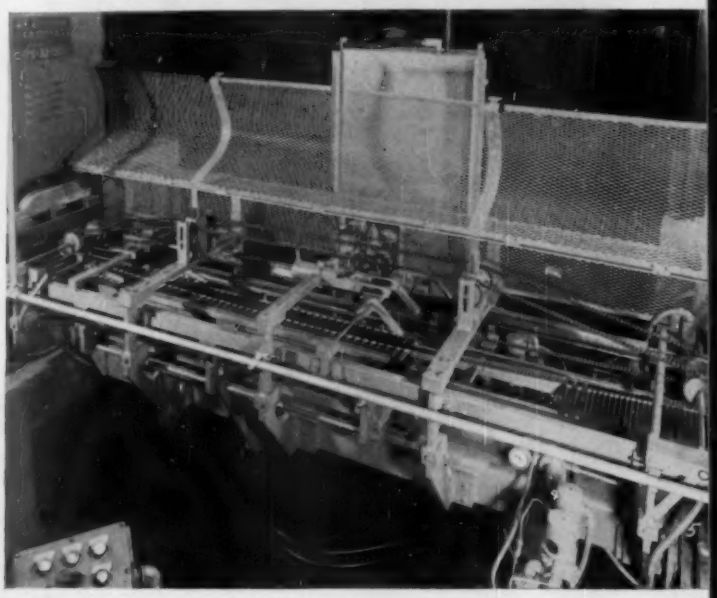
FAST SERVICE AND PARTS AVAILABLE FROM MAJOR CITIES, WRITE FOR CATALOGS

From strip steel to blower wheel cages–stamped and welded.

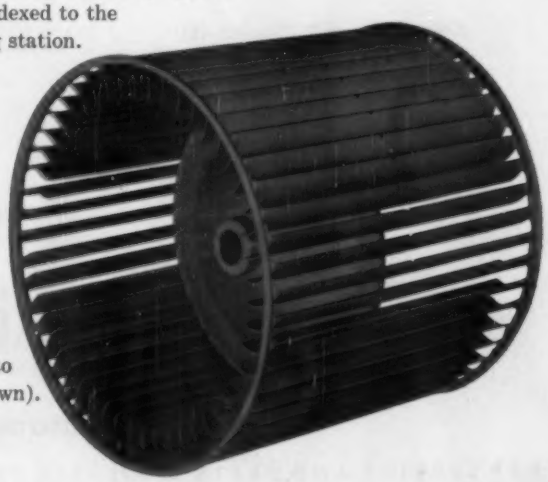
Another Packaged Manufacturing



Stamp—Strip steel enters the 75-ton Precision Flexopress through integral feed mechanism providing precise stock advance. Operating at 120 strokes per minute, the Flexopress pierces, lances and accurately forms the blower louvers. The exclusive "no float" ball bearing raceway construction of the Flexopress ram assures extreme vertical travel accuracy and parallelism giving longer die life.



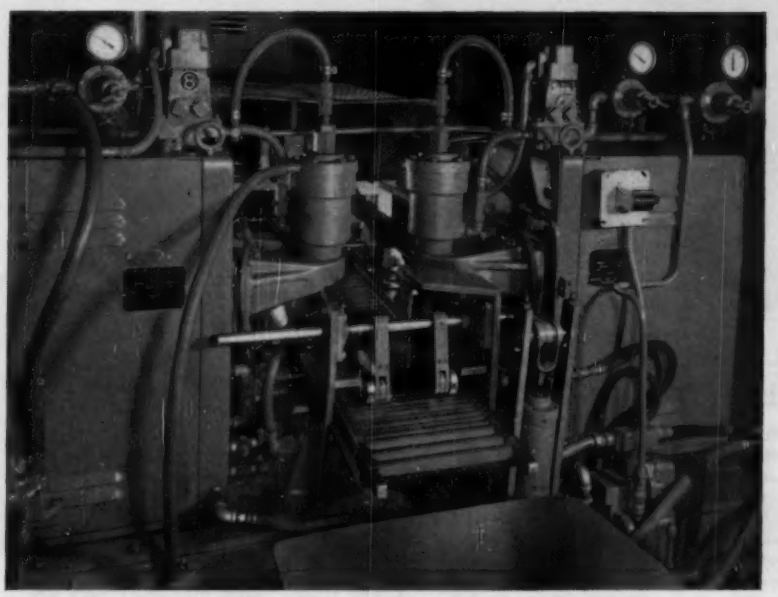
Assemble—Completed stampings are transferred by special tooling, designed and built by Precision. The first stamping is conveyed 3 feet, dropped into position on the lower track. The second stamping is then interlaced with the first and accurately positioned. Both stampings are then indexed to the welding station.

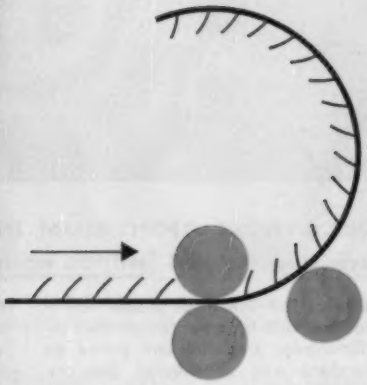


Completed—The exclusive Mayne blower wheel* with its simple, rigid construction, gives better performance, quieter operation and longer life. The Precision line changes over readily to many different-size wheels (10" model shown).

**Patent No. 2,431,647, other patents pending. Mayne Products Company, Dayton, Ohio*

Method by PRECISION

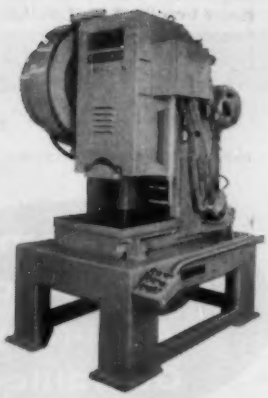




Weld—Two specially tooled standard 30 KVA bench welders automatically index and join the 2 stampings with 38 high-strength resistance welds. Adjustable limit switches automatically start electronic timer which sequences the weld and index. Production rate —up to 150 assembled and welded parts per hour— no operator required. The subassembly, completed on the Precision line is then rolled and beaded on other equipment.

Precision's Packaged Manufacturing Method. Put this to work for you. Go from raw stock to assemblies in one jump. As in the case of Mayne Products Co., we will work closely with your production and methods engineers. If you wish, we will do all production planning, engineering and tooling, deliver a complete production line to your plant ready to produce at the rate you need. Write today for complete information.

Standard PRECISION Bench Welder



Standard PRECISION Flexopress

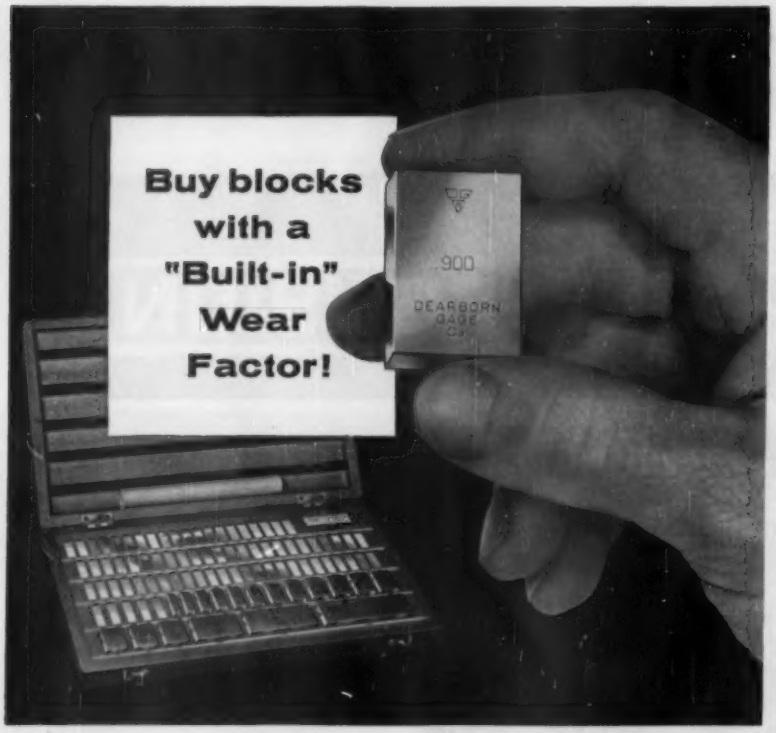
PRECISION

RESISTANCE WELDER MANUFACTURERS ASSOCIATION RWMA

PRECISION WELDER AND FLEXOPRESS CORPORATION

3520 Iboen Avenue, Cincinnati 9, Ohio

Builders of all types of Resistance Welders and Automatic High Speed Presses



ELLSTROM CHROMIUM PLATED GAGE BLOCKS
are guaranteed "minus nothing" from nominal size!

Here at last are gage blocks with a positive "built-in" wear factor! The only blocks ever produced and priced as standard with dimensional accuracy unconditionally guaranteed to be within specified millionths on the "plus" side of nominal block size and minus "zero" . . . absolutely nothing . . . undersize!

This complete elimination of the conventional minus tolerance gives you, the gage block user, three new and exclusive benefits. First, it provides positive assurance against receiving new blocks that are actually "worn" undersize during manufacture before they are ever used. Second, it gives you finer, more practical accuracy . . . with the sure knowledge that every Ellstrom block you buy will start wearing *toward* its nominal size rather than away from it. And third, it gives you a guaranteed minimum wear factor equivalent in millionths to the full minus tolerance specified as standard for all other makes of blocks!

Write for descriptive literature containing complete price information today!

ELLSTROM STANDARDS DIVISION

DEARBORN GAGE COMPANY
"Measuring in Millionths for Three Generations"
22038 Beech Street • Dearborn, Michigan

REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE UNITED STATES AND CANADA

Ellstrom Gage Block Accuracy Guarantee

"W"—WORKING ACCURACY BLOCKS
Measured Length: +.000008"/−.000000"
Parallelism: .000004" Flatness: .000004"

"I"—INSPECTION ACCURACY BLOCKS
Measured Length: +.000004"/−.000000"
Parallelism: .000003" Flatness: .000003"

"L"—LABORATORY ACCURACY BLOCKS
Measured Length: +.000002"/−.000000"
Parallelism: .000001" Flatness: 000001"

Ellstrom—your best buy in gage blocks for shop and tool room use, inspection and laboratory applications. Available in 28 standard sets ranging from 8 to 92 blocks in both square and rectangular styles with or without basic gage block accessories.

tion, is used. It is very seldom that new men are hired; usually they pull regular department employees.

We have to accept these things and cooperate with them. We do not like to get along with fewer men, but sometimes we do not see the whole objective.

Many new ideas are born in the experimental department. We do not mind experimental work if it provides a better way to do a job. The profits of the organization support us all.

My advice is to ride with and cooperate with all experimental work.

A E Salmons
Norristown, Penna

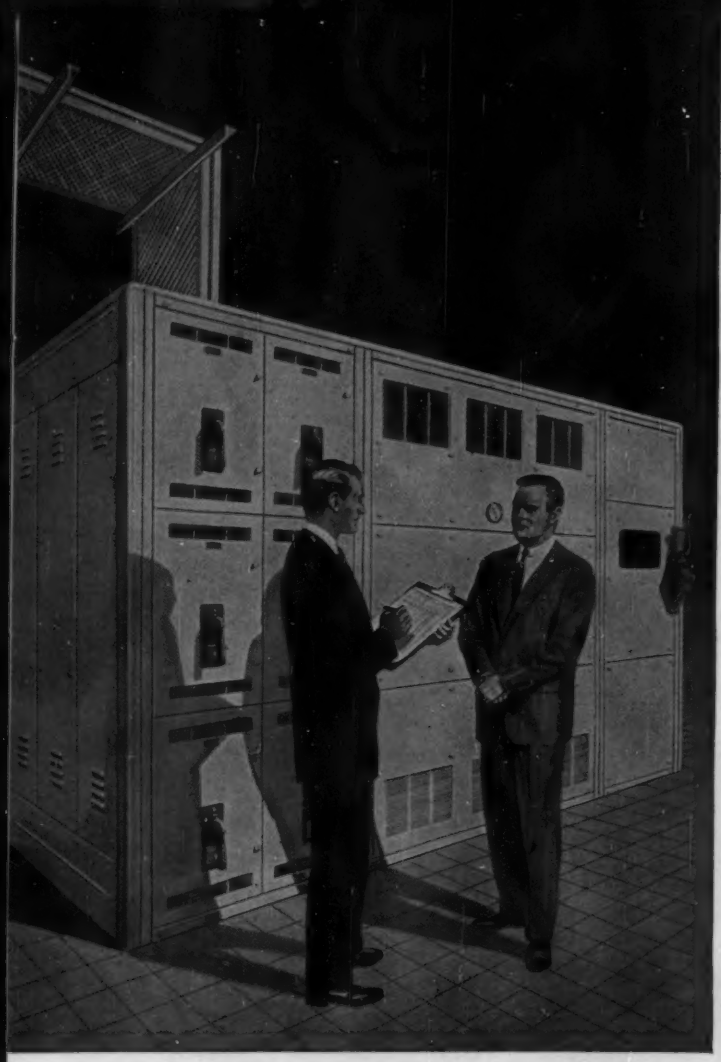
I DON'T SEE why Ed should worry so much about Hanson's development work. Neither is it proper to argue the matter with Harrison. If the superintendent takes a man from a foreman to do development work he's got orders from above about it, and that should not concern the foreman.

"Well, they've got Hanson over in the corner . . ." who does Ed call "they"? I presume he means Harrison, and if so, Ed should keep quiet; it is none of his business to try to change the decision of his superiors unless he has some very good reasons to put forth. This I cannot see he has done in this case.

In any production some development work must be carried on all the time. Some manufacturers prefer to experiment on their customers. But if they do that too much they

(Continued on page 270)

"That's final—if the next applicant doesn't shape up, you've had it!"



Unit-Versal® Switchboards permit additional capacity in new switches, even switchboard sections, to be added any time.

Vacu-Break® Power Panels feature interchangeable switch units. Switches are horsepower-rated, have interlocked doors.

Industrial Trol-E-Duct® feeds and supports light power tools on mobile trolleys, literally puts power on wheels!

Your BullDog Field Engineer will be happy to give you any additional facts on modernizing your power system. See him.

Power systems made to order for production increases

Expect to increase production now or in the future? If so, your electrical distribution system rates an A-1 priority. It's an area where returns far exceed outlay.

Take a BullDog distribution system, for example. All products are dependably built to perform efficiently, reduce maintenance and downtime. Designs are *flexible* so your changeovers can be made quickly and easily . . . so capacity can be added without obsoleting existing electrical equipment. From safety switches to unit substations, BullDog products are engineered to work well individually or dovetail into an integrated system that performs with top efficiency now . . . suits your requirements for years to come.

See your electrical contractor or consult a BullDog field engineer.

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BullDog Electric Products Company, Detroit 32, Michigan • A Division of I-T-E Circuit Breaker Company. • *Export Division:* 13 East 40th St., New York 16, N.Y. • *In Canada:* BullDog Electric Products Company (Canada) Limited, 80 Clayson Rd., Toronto 15, Ont.

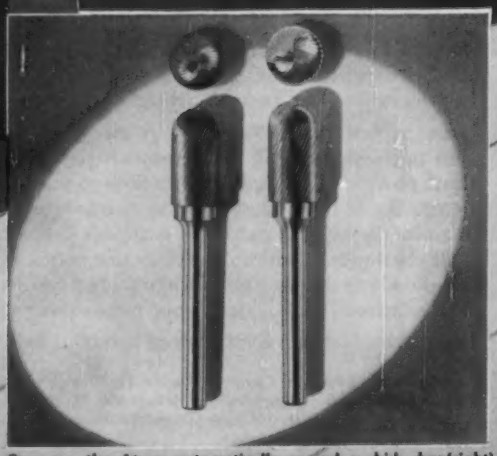
IF IT'S NEW . . . IF IT'S DIFFERENT . . . IF IT'S BETTER . . . IT'S

BULLDOG

ELECTRIC PRODUCTS COMPANY

A DIVISION OF I-T-E CIRCUIT BREAKER COMPANY

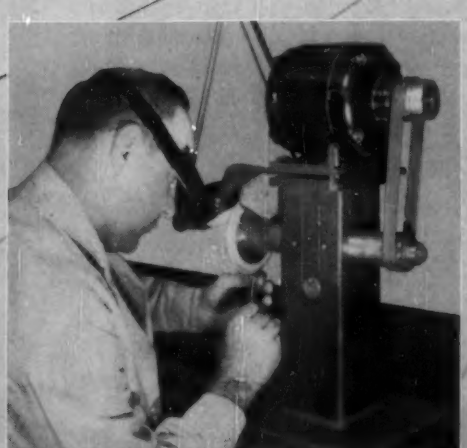
NOW *Carbide Burs are* EXPEN



Compare the Atrax automatically-ground carbide bur (right) with the manually-ground bur (left). Note the accurate, uniform fluting, sharp cutting edges and gem-like finish of the Atrax bur.

DABLE!

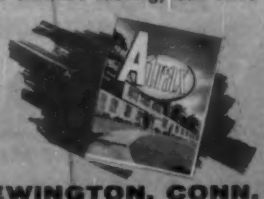
Automation By Atrax



Manual bur grinding is obsolete. It is a tedious operation, costing much more than Atrax automatic grinding. Flute uniformity depends entirely upon the skill and patience of the operator.

For the first time in the history of metalworking, carbide burs are being produced completely automatically! The manually-ground bur, costing 10 to 20 times more than high speed steel, is obsolete. Exclusive Atrax automated grinding is many times faster than hand grinding . . . cuts time and labor costs so low that Atrax Carbide Burs are now expendable tools!

Manual bur grinding is an expensive, time-consuming operation, much less accurate than Atrax automated grinding. Atrax Automatic Bur Grinders produce precision carbide burs—eliminate human error—insure absolute uniformity of bur size, shape, concentricity and fluting. Automated bur grinding is an exclusive Atrax development—proof again that Atrax, the leader in solid carbide tooling, can save money for every user of carbide and high speed steel burs!



Send for the new Atrax Catalog listing more than 850 standard Carbide Burs . . . products of Automation by Atrax.

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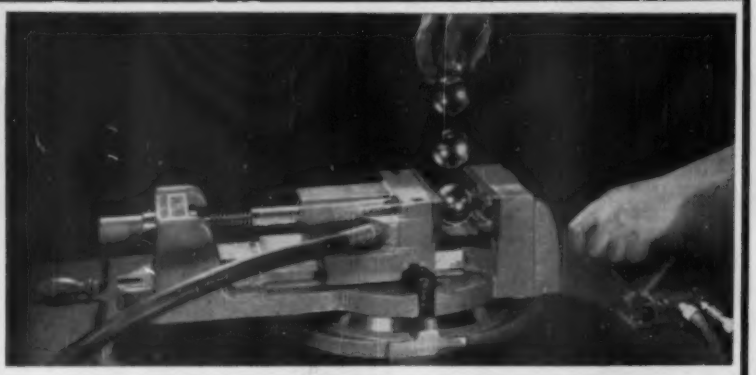

FASTER MACHINE LOADING? MILOMATIC IS ON THE BALL!

In the time it takes a 1" steel ball to drop 6 inches, MilOmatic air powered hydraulic vises close automatically! This split second automatic clamping action is the perfect way to cut costs and increase production on high speed operations, in which efficiency depends on fast loading and unloading. You can use MilOmatics on any machine in your plant, as an automatic production fixture, and you can adapt them to any work piece with low cost jaw inserts. Get on the ball! Get the facts about MilOmatic today!

Attach this ad to your letterhead for free demonstration or new free catalog!

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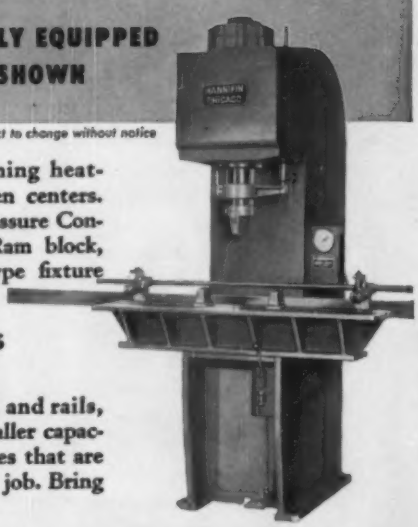
Sold By Leading Distributors The World Over

This 25-TON Hannifin Straightening Press Sells For $4,455 FULLY EQUIPPED AS SHOWN

Price F.O.B. our press plant at St. Marys, Ohio, subject to change without notice



The ideal press for straightening heat-treated parts up to 60" between centers. Exclusive Hannifin Sensitive Pressure Control for speed and accuracy. Ram block, two table blocks and center-type fixture complete with rails included.

STRAIGHTENING PRESSES FROM 5 TO 150 TONS

Hannifin offers longer tables and rails, roller-type fixtures, larger or smaller capacities (5 to 150 tons)—all at prices that are easily justified by savings on the job. Bring us your straightening problems.

HANNIFIN

HANNIFIN CORPORATION, 517 S. WOLF ROAD, DES PLAINES, ILLINOIS

will sooner or later be out-distanced by somebody else. The extent to which such development work should be done depends, of course, on the size of the production, whether a specialized product is manufactured or if everything is tailor-made, large or small work, number of models, etc.

Big concerns employ hundreds of men of all categories to develop certain machines or other equipment, whereas a small shop might order a man to use a day a week for experimenting on some details made.

To establish an experimental department employing a single man would be rather costly. If Ed is able to think at all he would agree on that, but it seems to me that this is not the main point in his arguments. Ed is sore at Hanson because he cannot control him any more, but, by showing that, he's probably got a bigger head than Hanson, which exposes a bad side of his character.

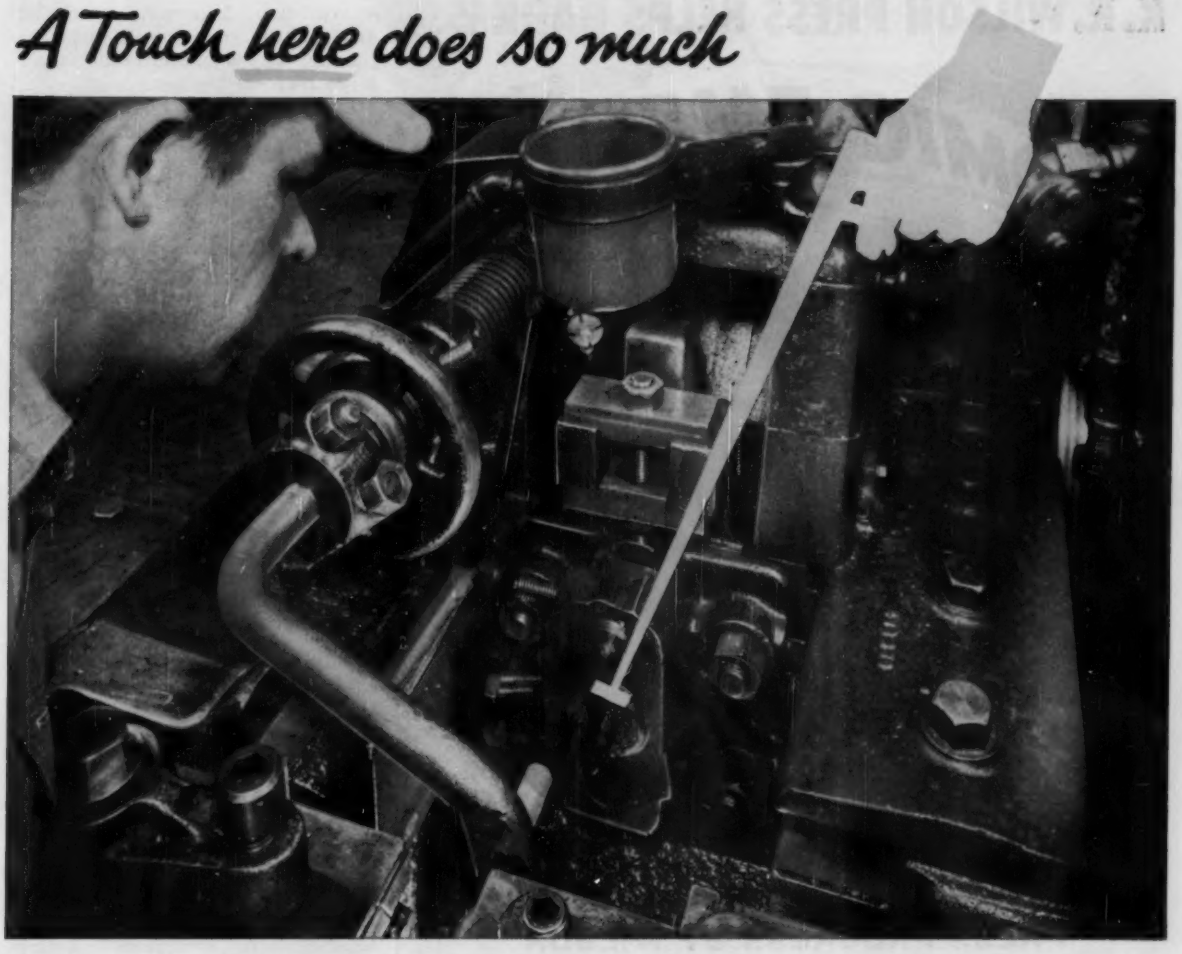
Harrison, I am sure, has considered the economic side of this proposition before he ordered Hanson to do this development job. The production space Hanson occupies cannot be important enough to affect Ed's budget.

Hanson is fooling around and wasting Ed's time? How can that be, when Ed is so eager to get him back on production work as being one of the more experienced men of his crew, and also because Ed claims he cannot control him? Evidently Ed is blowing steam or hot air. He should know better than talking nonsense like that.

Why doesn't Ed take it easy for a while? But what about Al's suggestion that Ed will get Hanson back if they get anything out of his development job? It should be the other way about. I think if Hanson

"This young man has a lot of ingenuity and know-who. He's the boss' son."

A Touch here does so much



COOL PROFITS FROM HOT HEADS

A touch of 'dag'® 200 on the punch that sinks hexagonal recesses in steel screwheads increases efficiency 40%, doubles production, and improves quality. Two operations and a bulky machine are eliminated, and 42 square feet of floor space gained per machine. Life of the hex punches is extended over 500%.

Before using 'dag' 200, the die in the hammer head seized and pulled out when punched into the white hot blank, resulting in costly rejects and downtime. The unique properties of 'dag' 200, a dispersion of molybdenum disulfide, keep the hammer slamming 2,500 blanks per die — six times more than before. Three hours' downtime is saved per die, and only two-and-a-half gallons of 'dag' 200 are needed to produce 21,000 units.

This is only one of the many Acheson colloidal dispersions which keep things moving fast in hundreds of industries. Talk with your Acheson Service Engineer soon, and write for Bulletin 426, Metalworking Applications. Address Dept. **AM-5.**

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ACHESON COLLOIDS COMPANY

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ACHESON COLLOIDAL DISPERSIONS:
Graphite · Molybdenum Disulfide · Zinc Oxide · Mica and other solids

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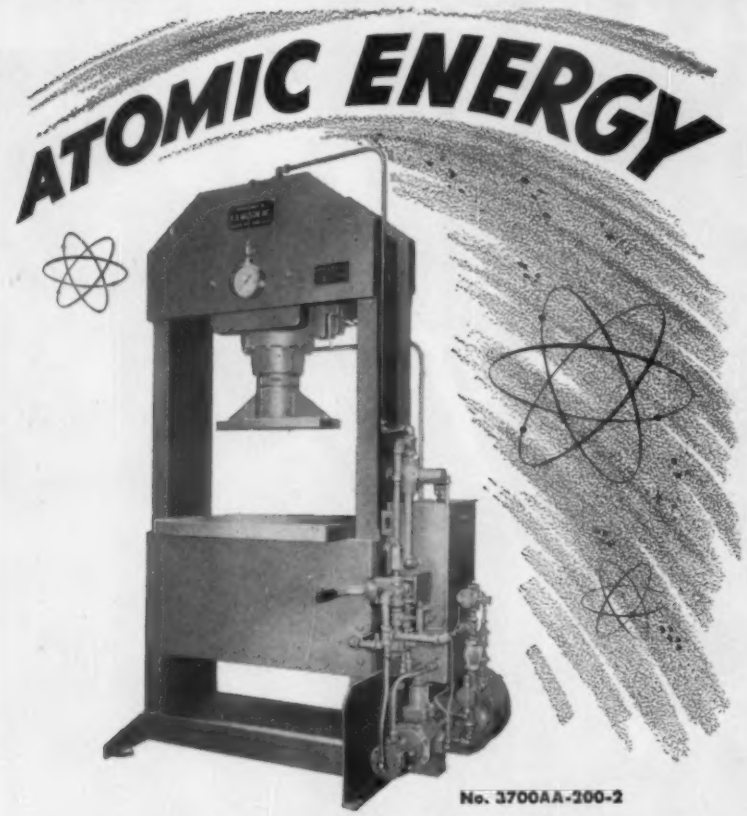
K. R. WILSON PRESS HELPS HARNESS ATOMIC ENERGY



No. 3700AA-200-2

DRAMATIC EXAMPLE OF PRESS PROGRESS BY WILSON

Zirconium! . . . in this single word lies a story of remarkable press progress at K. R. Wilson. A press was needed for cutting and pressing zirconium, glistening metal vitally important in the construction of nuclear reactors for atomic energy. The problem was put to Wilson engineers. *The challenge was accepted and a press was built to do the job!* The K. R. Wilson 3700AA-200-2 200-Ton Capacity Motor Driven Hydraulic Press combines all the features necessary to cut and press zirconium with maximum efficiency and economy. The 3700AA-200-2 is but one of scores of examples of the years-ahead technical thinking that makes any type of Wilson press your wisest buy.

CONSIDER THE FEATURES AND YOU'LL CHOOSE WILSON
MODEL No. 3700AA-200-2

HEAVY DUTY RAM 6" diameter heat treated and ground alloy steel ram. 10" bore. 18" stroke.

DOUBLE ACTING CYLINDER Provides power on upstroke for stripping and to offset weight of tooling.

COMPLETE RAM CONTROL Stops in any position; allows you to raise just enough to clear work.

GUIDED RAM Non-rotating ram completely eliminates ram turning.

SIDE-MOUNTED HYDRAULIC UNIT Requires minimum amount of floor space; easily accessible for service.

RAM SPEEDS Rapid Idle Approach Speed to 23 tons, 52" per minute. Pressing Speed to 200 Tons, 8¾" per minute. Rapid Idle Return to 15 Tons, 75" per minute.

FOR FULL DETAILS WRITE FOR BULLETIN No. 37

HYDRAULICS DIVISION
K. R. WILSON, Inc.
OFFICES AND FACTORIES — 210 MAIN ST., ARCADE, NEW YORK, U.S.A.

is capable of developing something new and better in his development job they will keep him in his corner to do more of the same work.

If Ed needs more help immediately he should hire a new man and don't gripe about Hanson. If he is not permitted to do so by Harrison he should sit tight and not make so much fuss about this necessary development job. If Harrison won't believe Ed needs more help Ed should know that Harrison is responsible if he gets behind schedule.

A E Fristedt
Stockholm-Bromma, Sweden

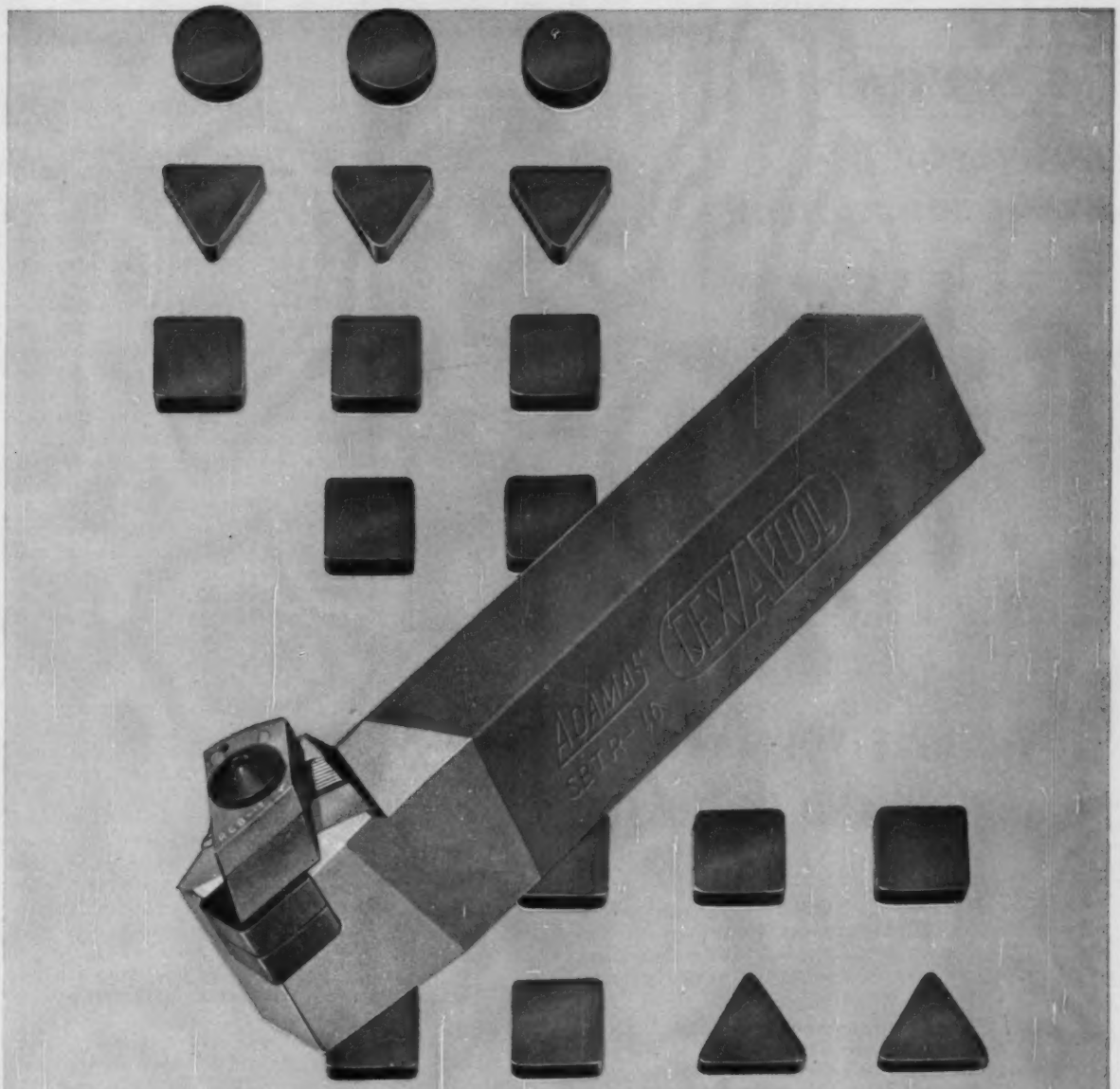
WHO BUYS THE TOOLS?

Should the company be responsible for all tools, including those owned by the workers? Is it the company's responsibility to replace stolen tools, if the theft takes place in the shop?

IN ANSWER to the query "Should the company be responsible for all tools, including one-inch micrometers," my experience is that most mechanics like to have a kit of small tools of their own. They have a pride in their kit and take great care of those tools. Men on bonus work find it an advantage to have a private kit so that they are not held up at any time walking to the stores, sometimes standing in line waiting to be attended to. I think the idea is a good one; it helps to fill the pay envelope. It also helps to keep production at high level.

Some foremen regard the quality and range of the private kit as a guide to the quality and character of the tradesman. I am not so sure about the character claim, but I do believe that the private tool kit is a reliable pointer to the owner's interest in his trade and his capability as a tradesman. If we except scales, small micrometers, small squares and small calipers, tools are less important today than yesterday. The accuracy with which parts can be machined now renders many of yesterday's tools obsolete.

Hand tools and fitters are rapidly giving way to lapping machines and assembly men—or women. Although I agree that an interested mechanic should be encouraged to possess a private kit of tools, I don't think the company should be held responsible for them. I know the modern tendency is for everything to be owned by the company. Al-



4 WAYS BETTER

- Fully adjustable chipbreaker
- Invertible and indexable carbide or steel anvils
- Holds both 3/16" "thick" inserts and 1/8" "thin" inserts
- Choice of standard or setscrew chipbreaker clamps

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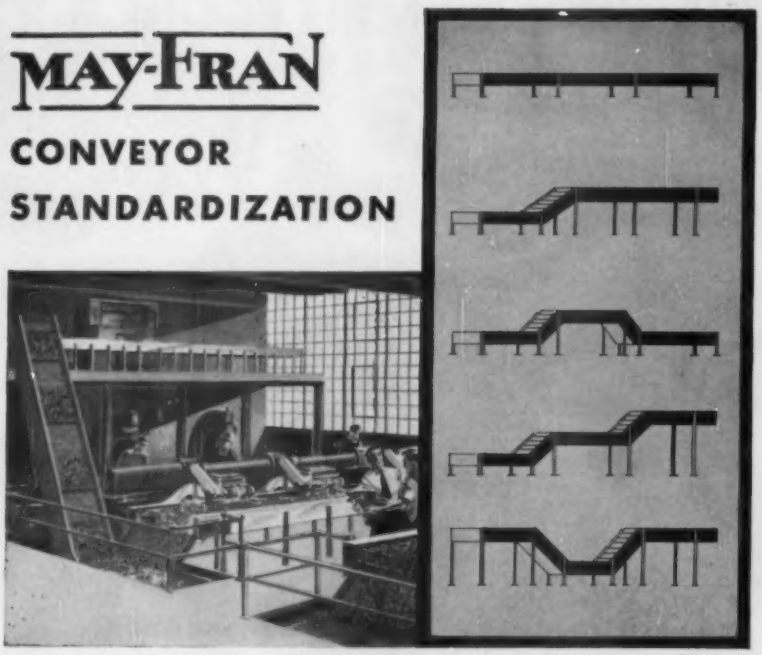
PRODUCERS OF TUNGSTEN CARBIDE TOOLS, TOOL TIPS, DIES, WEAR PARTS, DEX-A-TOOL AND CERALOX.

MAY-FRAN

CONVEYOR STANDARDIZATION



. . . SAVES YOU MONEY

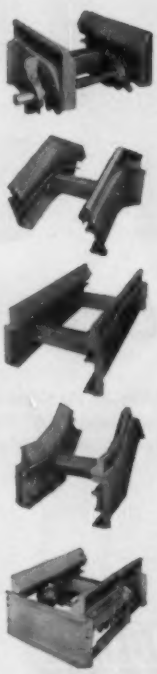
. . . NOW AND IN THE FUTURE!

Here is a conveyor program designed for the unusual. NOW . . . you can have a customized conveyor today to meet production needs . . . and with modification, that same conveyor will meet the needs of tomorrow.

The May-Fran conveyor standardization program provides the standard components that can be assembled to form a special or standard conveyor. These same components can be re-arranged at any time to solve production problems in the future.

In addition, standard components mass produced mean conveyor economy right from the beginning.

Here is a conveyor program of standardization program that saves you money now . . . and in the future!



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7800-MF

MAY-FRAN ENGINEERING, INC.

1677 Clarkstone Rd., Cleveland 12, Ohio

ready, they practically own our bodies. Leave us the pleasure of a compact, neatly arranged, well kept kit that none can lay claim to but us.

We will keep it in good shape by our own unaided efforts, Mr Editor, and it may be a guide to our standing as mechanics and to our acquired skill. It may even be an inspiration to our less interested workmates.

While I appeal to be allowed to keep our own private tools, the company, in its own interests, should stock all necessary tools for general issue as required. I don't think the company should insist that only tools supplied by them are to be used in the shops. That is a backward step not in tune with the employers' professed desire that the men should be encouraged to take an interest and a pride in the company and its products.

They want the men to be intimate, to feel that they belong. They put on special displays of their products and encourage the men to bring their wives and families along to see the show and to walk around the shops to learn something about the old man's job and, perhaps, something of his standing in the company and the respect in which he is held by his foreman and workmates. So far, that is all good. It is far-seeing, humane management, but what could be more intimate, more suggestive of identity with the company than a private kit of tools, many of them made with a view to insure speedy and accurate handling of the particular product manufactured by the company.

Men who are sufficiently interested in their job to so employ their ingenuity and resource pay the company a very high compliment. I certainly would not forbid any man to use a private kit of tools, nor would I insist on him using company-owned tools, exclusively. I take my hat off to those men and give them the maximum of encouragement. They are in short supply and too valuable to be censured or ignored.

It might not be a bad idea to have a yearly shop show of private kits and to invite the wives, sweethearts and families of the entrants. That would create a climate of interest and intimacy and help on the goodwill in industry so eagerly sought after by enlightened management. A worthwhile prize for the winning kit would heighten interest all around.

I J Parkinson
Northants, England

Fully Automatic Finger-Tip Controls

Reid-O-Matic Model 824 . . . the most versatile surface grinder in today's metalworking field, is completely electric . . . fully automatic. A control panel, at finger-tip level provides complete power control of all grinder adjustments.

Reid-O-Matic operators can "set-up" faster . . . change settings quicker . . . produce close tolerance grinding in the toolroom without unnecessary labor. For your surface grinding specialists, the new Reid-O-Matic is a "Production Giant."

SPECIFICATIONS

Capacity:	8" wide, 24" long, 21" high from table to center of spindle. Standard wheel 12" x 3" x ¾" included.
Table Speed:	Infinitely variable from 0 to 90 F. P. M.
Cross Feed:	Infinitely variable from .001 to .250.
Floor Space:	93" x 51½" x 71¾" high.
Weight:	4,000 lbs., Net.

For Production and Toolroom Grinding . . .

REID BROTHERS COMPANY, Inc.

133 Elliott Street, Beverly, Massachusetts

Write for Bulletin 824

MANUFACTURERS OF PRECISION SURFACE GRINDERS AND PRODUCTION LATHES

D&L* selects

Magnamatic "One-Shot" Screwdrivers provide precise torque control in D&L's new multi-spindle unit.

D&L TOOL AND MACHINE COMPANY*

990 S. Oakwood, Detroit 17

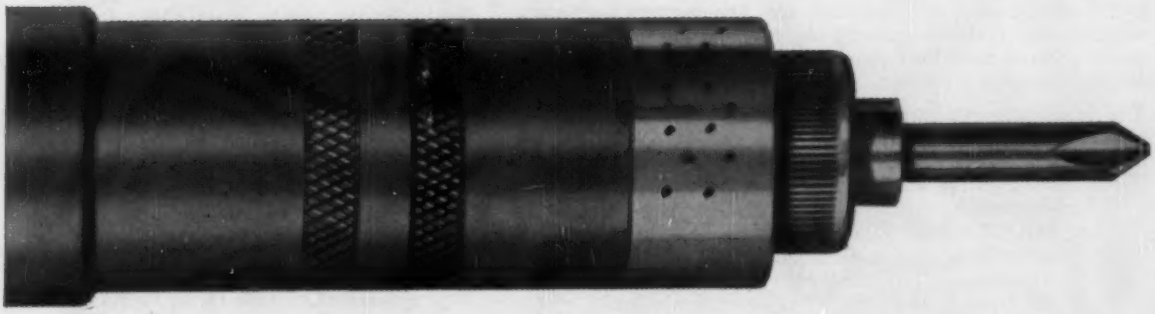
Manufacturers of automatic single and multi-spindle screwdrivers and nutrunners for automation assembly lines.

"MAGNAMATICS"...

The D&L Tool and Machine Company's newest development is a fully automatic multiple screwdriver that feeds and drives five screws simultaneously *to desired torque* . . . at a rate of 3500 screws an hour!

D&L's development engineers specified "One-Shot" Magnamatic drivers. Studies from hundreds of difficult fastening assignments proved that Magnamatic is the only screwdriver clutch that fully meets the demands of high speed, fully automatic screwdriving equipment. Because Magnamatic "thinks for itself", its torque-setting clutch jaws disengage the instant desired fastener torque is reached . . . there's no clutch ratcheting or impacting to cause jaw wear . . . the absence of ratcheting means consistent torque settings that don't need readjustment; the absence of impacting means longer bit life, and no possibility of burred screw heads, stripped threads, or sheared fasteners . . . air line pressure variations don't affect delivered torque . . . torque output can be changed to suit job requirements.

Investigate the possibilities of Magnamatic. Let our Field Engineers show you how the wear-free clutch components of Magnamatic "One-Shot" screwdrivers and nutrunners will insure accuracy and consistency in all automatic multiple units.



Complete line of motors and clutches available for constructing multi-spindle screwdriving and nutrunning arrangements. Capacities #2 screws to bolts requiring 120 pounds of torque.

Portable multi-spindle units featuring Magnamatic "One-Shot" nutrunners and screwdrivers are also available.

Chicago Pneumatic

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_____Please send me full information about multi-spindle units featuring "Magnamatic" screwdrivers.

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"We've had total savings of more than $100,000 since we purchased the analyzer three years ago. The analyzer has been shipped over 100,000 miles by air, rail, and car to our eight plants without need for repairs or replacements" — reports a leading chemical processor.

The Machinery Analyzer — actually a portable IRD Vibration Analyzer — is used for . . .

- TROUBLE-SHOOTING — to pinpoint faulty components exciting vibration *without costly dismantling.*
- MEASURING DISPLACEMENT — to accurately determine the condition of machinery *without costly dismantling.*
- IN-PLACE BALANCING — to dynamically balance at operating speed the accessible rotating components *without costly dismantling.*

Here are several examples cited by company officials:

- Detecting a broken gear in an important gear reducer saved a major loss of production.
- Savings of $2000 in balancing a ringer assembly because dismantling and loss of production were eliminated.
- A 450 HP motor was balanced, in place, at savings of $8000 to $10,000 in production and maintenance costs.

What portable IRD Vibration Analyzers are doing for this company — to reduce inspection, maintenance, and production costs — it can do for your company.

IRD

For further information — or an actual demonstration on your own machinery by an IRD field engineer — write today to International Research and Development Corporation 797-AM Thomas Lane, Columbus 16, Ohio.

New Books...

PHASE DIAGRAMS IN METALLURGY — *By Frederick N Rhines. Published by the McGraw-Hill Book Co, 330 West 42nd St, New York 36. 340 pages, 6 x 9 in. Price $12.50*

Phase diagrams help the engineer and metallurgist to understand the changes that take place in metals from heating, cooling, compressing or expanding operations. A number of books have been published abroad on the phase rule in metallurgy and chemistry, but this appears to be the first comprehensive American text on the metallurgical aspects of the subject, without inclusion of burdensome thermodynamics.

•

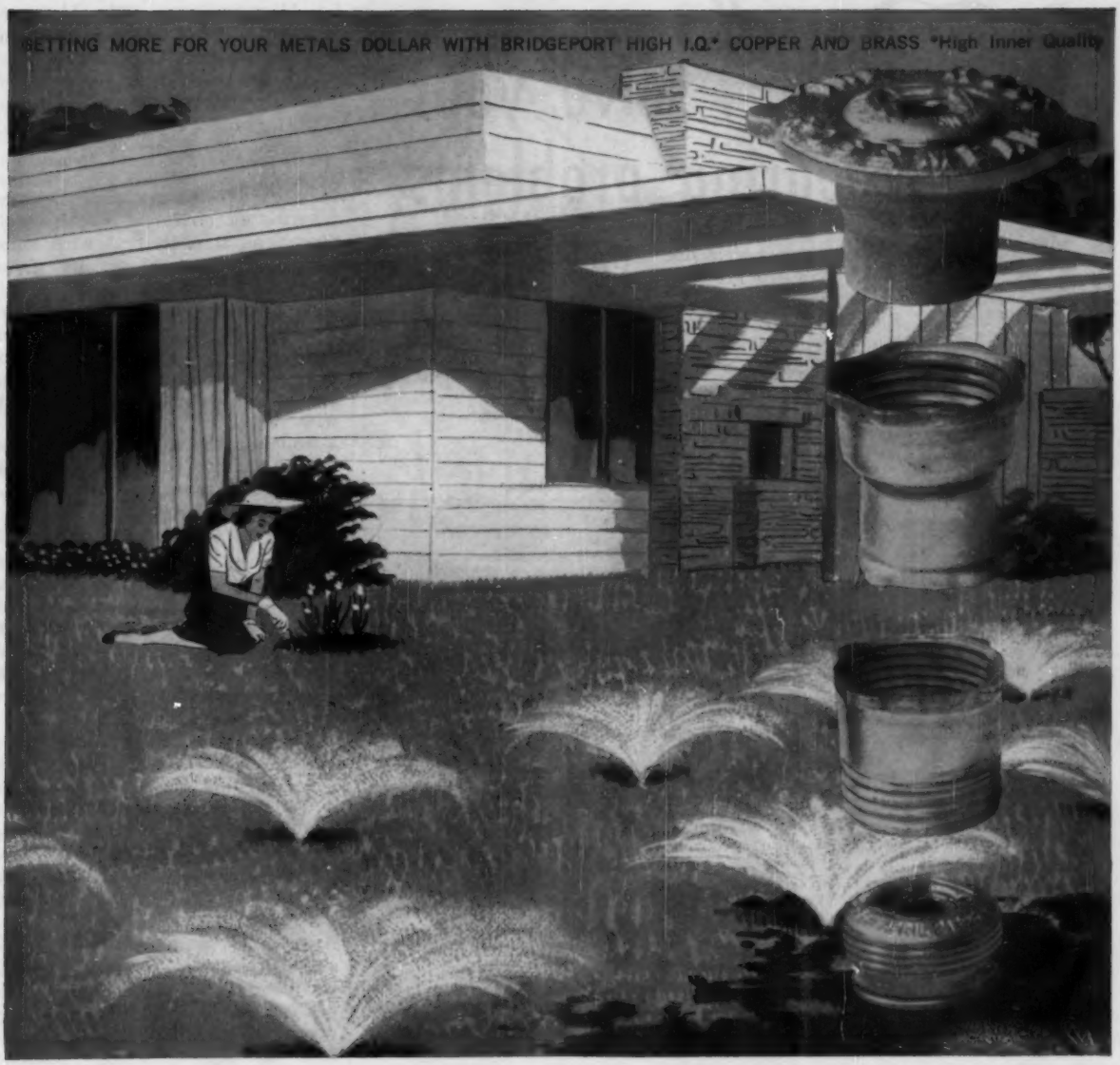
NEW FRONTIERS FOR PROFESSIONAL MANAGERS—*By Ralph J Cordiner, president, General Electric Co. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, NY. 121 pages. $3.50.*

How do you manage a company with 350 product lines, about 3 million catalog items, and a sales volume of $3 billion? If you are General Electric, you do it by decentralization. But how do you achieve this decentralization? Ralph Cordiner answered this question in a provocative series of lectures sponsored by the McKinsey Foundation and Columbia University.

Mr Cordiner outlines the principles of GE's program. One of the key requirements seems to be confidence that associates in decentralized positions will have the capacity to make sound decisions in the majority of cases. Men who believe in decentralization down to themselves and no further will keep their organization in confusion and prevent the growth of self-reliant men. This is still a problem at GE, as would be expected after only six years under this philosophy.

Operating Departments make their own budgets, set their own prices, and have authority to approve capital expenditures up to $500,000. Mr Cordiner believes that too much of a fetish has been made of capital expenditures. A manager can lose a lot more money on inventory, foolish pricing policy, careless personnel staffing, or poor production scheduling.

These are only a few of the many points that are made in this book. It provides a rare view of a big corporation from the top looking down.



How to "water down" a tough forming and machining problem

Is there a metal ductile enough to undergo severe right-angle forming and drawing without cracking? Can this metal be machine-threaded easily and economically inside—and outside, if necessary—after forming? Can all this be done on *our* machines, the way *we* do it?

These questions were asked by Ross Sprinkler Co., Rosemead, Calif., and answered by Bridgeport Medium Leaded Brass Strip, Alloy #63, 12 B&S Gauge—a *standard* Bridgeport Alloy at a *standard* price. The result? The sprinkler head and accessories you see here—plus a lot of satisfaction and production savings.

To help achieve similar efficiency and economy in your operations take advantage of Bridgeport's expert help and assistance in selecting the alloy best suited to your own production requirements and product end use. Call your nearest Bridgeport Sales Office today.

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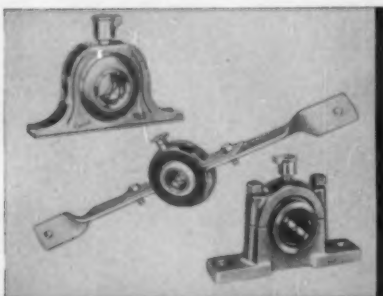
matched Bridgeport Brass Alloys *to your job*

let Randall solve your sleeve bearing problems

Randall manufactures a complete line of bronze sleeve bearing assemblies, standard bronze bushings, bronze bars and graphited bronze bushings. For many applications, Randall will be able to make immediate delivery from stock. Randall will work with you in solving your application problem requiring a design modification or special type bearing or bearing assembly. For the most efficient and economical solution to your sleeve bearing problems, contact Randall with your sleeve bearing requirements.

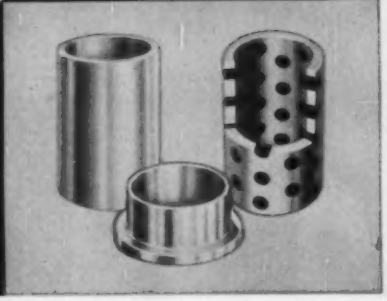


SELF-LUBRICATING BEARING ASSEMBLIES

There is a quiet, self-lubricating, self-aligning, low-cost Randall Pillow Block or bearing assembly for every type of application. The exclusive Randall "DEEP-WELL"® ball assembly is basic to all Randall designs. It incorporates a unique double-lubrication feature which permits extended periods of operation without maintenance.

STANDARD AND SPECIAL BUSHINGS

Randall is also a dependable source for other bronze bearing requirements—bronze bars . . . standard bronze bushings . . . and graphited bronze bushings. All are products of careful foundry practice and precision machining. Immediate delivery of stock sizes.



All Randall graphited bushings feature Randall's exclusive graphite formula offering the efficiency and protection of double lubrication. Randall's porous graphite mixture can hold a reserve of oil where it is immediately available to the bearing surface and will not wash away or create oil sludge. Call your Randall distributor today. He's listed in the yellow pages of the telephone directory under "Bearings."

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Clip this coupon to your letterhead, include your name and department and send it to Randall Graphite Bearings, Inc. We will send you the complete Randall ☐ Pillow Block and/or ☐ Bronze Bushing Catalogs. Please check your interest.

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LA MACHINE-OUTIL (THE MACHINE TOOL) VOL V, MACHINING TEETH AND THREADS. *Published under the direction of A R Metral by Dunod, 92 Rue Bonaparte, Paris VI, France. 614 pages 7¼ x 10½. Price 8800 francs ($25)*

This is Vol V of a monumental work covering all phases of machine-tool operation. It deals first with hobs and hobbing machines and gives complete details of the operation of both machines and tools. Similar treatment is given to gear cutters, and bevel-gear generators. Tooth correction and inspection, including grinding and shaving, are also dealt with.

Under threading, the methods described include rolling, single-point and diehead threading, thread milling, and thread grinding.

Readers who can understand French will find this and the others in the series, extremely interesting, as they deal with machines produced in various European countries as well as in the USA. The books are well illustrated with photographs and line drawings.

•

MACHINE TOOLS FOR METAL CUTTING —*by W H Armstrong, Professor of Industrial Engineering, The Pennsylvania State University. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, NY. 347 pages. Price $5.00*

A general introduction to the machine shop for engineering students, this book devotes a chapter to each of the major types of chip-producing operations: turning and boring, drilling, milling, grinding, planing, broaching, and cutting-off and sawing. Within each chapter, the basic machines and some of their variations are described in pictures and words, giving a background on how they are constructed, how they operate, and what kinds of work they can do.

Several chapters cover such basic principles as measurements, metal fits, metal cutting, and abrasives, bonds, and grinding wheels. Some of the recent developments in electrical, ultrasonic, and chemical machining are touched upon briefly, and some concept is given of the principles of automatic production.

The information in this book is necessarily quite general, but, for the person who has spent little or no time in a machine shop, it will provide some familiarity with machine tools and their applications.

Names in the News . . .

Carroll C Parker has been appointed grinding wheel sales manager for the mechanical goods division of US Rubber Co. Formerly assistant sales manager, he replaces **J A Fairfield,** who has retired.

Frank M Mansfield III has been named vice president and sales manager of Wagner Brothers, Inc, producer of plating equipment. He was previously manager of product planning for General Electric Co's Metallurgical Products Dept, Detroit.

Joseph H Reid, a vice president of National Lead Co, has been appointed general manager of the Titanium Division. **Graham W Corddry,** assistant manager of the division, has been named manager. **Leo L Lewis** has been made production manager.

W W Lampkin, director of manufacturing for the Aircraft Division of Hughes Tool Co, Culver City, Calif, has been elected national chairman of the Aircraft Industries Association's Manufacturing Committee. He succeeds **R A Fuhrer,** chief tool engineer for the Fort Worth, Texas, plant of the Convair Division of General Dynamics Corp. **G T Willey,** vice president, manufacturing, for the Martin Co, Baltimore, has been named vice chairman.

Roy M Skeirik has been appointed manager of the production department's mechanical assembly section at the ElectroData Division of Burroughs Corp, Pasadena, Calif.

David D Mason, a vice president of Link Aviation, has been named, in addition, assistant general manager in charge of manufacturing, engineering, sales, and western operations.

William P Hall, executive vice president of the Maryland Shipbuilding & Drydock Co, Baltimore, has been elected president to succeed **George H French,** who has retired

John H Diehl, assistant works manager of Allis-Chalmers Manufacturing Co's LaPorte, Ind, works, has been named assistant to the vice president in charge of the Power Tool Division of Rockwell Manufacturing Co. **Herman Gottwald,** formerly eastern regional sales manager for Rockwell's Meter & Valve Division, has been made assistant vice

WHAT'S THE FASTEST WAY TO CLEAN METAL?
See page 11
WHAT'S THE MOST ECONOMICAL WAY?
See page 9
Some good things to know about Metal Cleaning
OAKITE PRODUCTS, INC.

Oakite's FREE Booklet on Metal Cleaning

answers many questions that mean better production, more profit for you. Just look at the table of contents:

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- Electrocleaning nonferrous metals
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- Applying iron phosphate coatings in preparation for painting
- Applying zinc phosphate coatings
- Cleaning, removing rust and conditioning for painting in one operation
- Machine cleaning methods
- Paint stripping
- Steam-detergent cleaning
- Barrel finishing, burnishing
- Better cleaning in hard water areas
- Treating wash water in paint spray booths
- Rust prevention
- Machining and grinding

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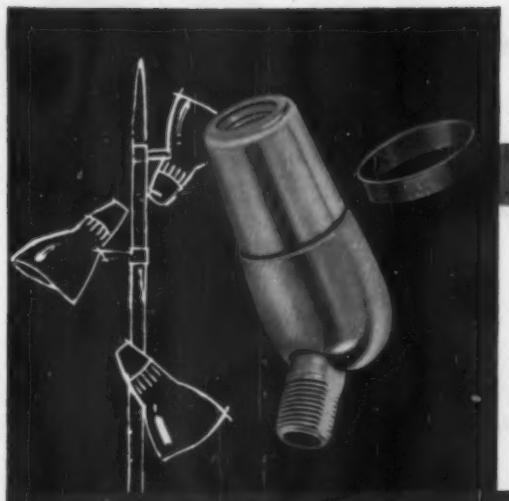
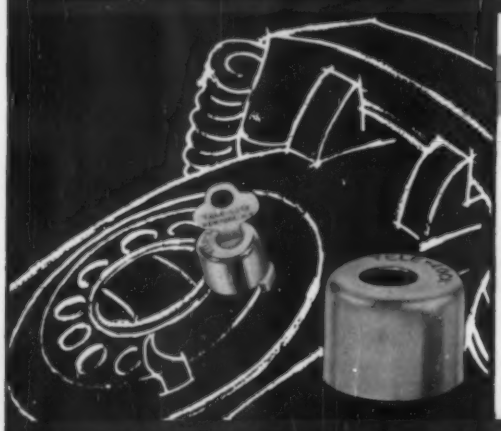


How three manufacturers use Anaconda superfine-grain alloys

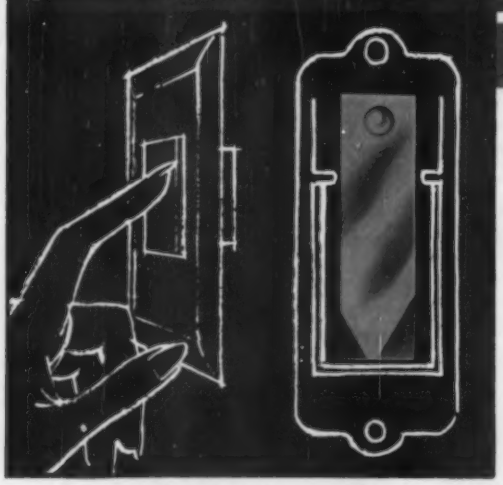
DURAFLEX makes swivel lamps swivel better

Berger Machine Products of Maspeth, New York, manufacturers of lighting-fixture parts, had a problem with a swivel fixture. To allow adjustment of the reflector, the two steel parts (illustrated) have to rotate 350 degrees. Steel-on-steel froze and locked. A brass ring bushing helped, but being soft allowed the steel to cut in and bind. Berger tried Duraflex, Anaconda's superfine-grain phosphor bronze, and found the answer. Its springiness, hardness and wear-resistance made a snug fit which turned easily and would hold in any position.



FORMBRITE® helps finish phone locks faster

Tele-Lock, an ingenious device for locking a dial phone, is encased in a chromium-plated brass cup. Slaymaker Lock Co., Lancaster, Pa., was using ordinary drawing brass for this cup and found finishing costs high. They turned to Formbrite, Anaconda's superfine-grain forming brass. The cups were easy to form; the slight extra spring and hardness made the fit perfect. The smooth surface of Formbrite eliminated one polishing operation and provided an ideal surface for a lasting chromium plate.



DURAFLEX makes superior contacts for Touch-Plate®

Touch-Plate Mfg. Corp., Long Beach, Calif., makes low-voltage switch systems for control of lighting in the home. It takes only a flick of the finger or elbow on the momentary contact switches to actuate a relay, or set of relays, which turns lights on or off in one room or through the house. For the contact strips in Touch-Plate wall switches they now use Duraflex, Anaconda's superfine-grain phosphor bronze, because they found it has more spring, better recovery properties. Duraflex is now used also for contacts in the relays which operate the Touch-Plate system.

FOR INFORMATION WRITE: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

8767

DURAFLEX

The new superfine-grain phosphor bronze with greater endurance limit.

FORMBRITE

The new superfine-grain drawing brass that cuts finishing costs.

ANACONDA®

PRODUCTS

MADE BY THE AMERICAN BRASS COMPANY

president of the division and product manager in charge of valve sales. **Donald C Morgan,** central regional sales manager, has also been named assistant vice president, and product manager of gas products sales.

Henry Larsen has been appointed assistant general works manager, Tractor Group, Allis-Chalmers Manufacturing Co, Milwaukee. He succeeds **Owen J Higgins,** recently named general manager of the Harvey, Ill, works. Mr Larsen has been serving as assistant to the Tractor Group vice president and general works manager.

Emerson L Claussen has been elected vice president in charge of standard products sales of Standard Screw Co. He was formerly sales manager of standard products for the Chicago Screw Co division of the firm in Bellwood, Ill, where he will continue to make his headquarters.

A Robert Stone, formerly plant foreman, has been named assistant general manager of Stone Machinery Co, Manlius, NY, manufacturer of high-speed cutting machinery.

Clarence P Sander, general superintendent, Vernon Plant, Consolidated Western Steel Division of US Steel Corp, Los Angeles, has been elected president of the American Welding Society. **Gustav O Hoglund,** head of the welding section of the Alcoa Process Development Laboratory, New Kensington, Penna, has been named first vice president, and **Charles I MacGuffie,** manager of marketing of the Welding Department of General Electric Co, York, Penna, has been appointed second vice president of the Society.

H C Deckard has been named director of manufacturing of Wickfield Aviation, Inc, Dallas, Texas. The firm has been formed to design and build aircraft and missile ground support equipment, and to conduct advanced research and development work in the missile field. Prior to joining the company Mr Deckard was associated with Convair-Fort Worth as executive assistant to the vice president.

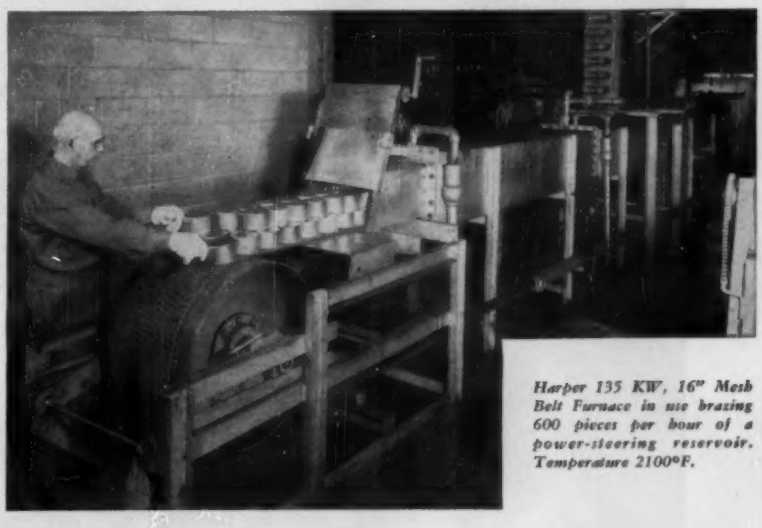
Paul W Brannon, production manager of Brad Foote Gear Works, has been appointed factory manager of the Chicago plant.

Glenn A Stertzbach has been appointed master mechanic at George

(Continued on page 286)

Want Higher Furnace Production? . . . .

MODERNIZE WITH HARPER HIGH TEMPERATURE MESH BELT FURNACES



Harper 135 KW, 16" Mesh Belt Furnace in use brazing 600 pieces per hour of a power-steering reservoir. Temperature 2100°F.

If you need up to 50% greater continuous furnace capacity without increasing space; and if your operating temperature range is 1800°-2100°F, a modern Harper Mesh Belt Furnace may well be the answer to your requirements.

These compact continuous furnaces are designed to utilize fully the advantages of silicon carbide heating elements* and today's high temperature oxidation-resisting alloy mesh belts.

Silicon carbide resistance heating elements allow high concentration of heat in a small space, thereby providing considerably greater production than furnaces of similar size using ordinary nickel alloy elements. Silicon carbide elements are also replaceable without complete furnace shutdown.

Two more important advantages of Harper Mesh Belt Furnaces are:

1. MULTIPLE-ZONE HEAT CONTROL — Heating elements are connected in several individually-powered and controlled zones for maximum flexibility of the heating curve.
2. PRODUCT UNIFORMITY — Furnace design based on many years of experience plus properly applied control instrumentation means uniform product day after day.

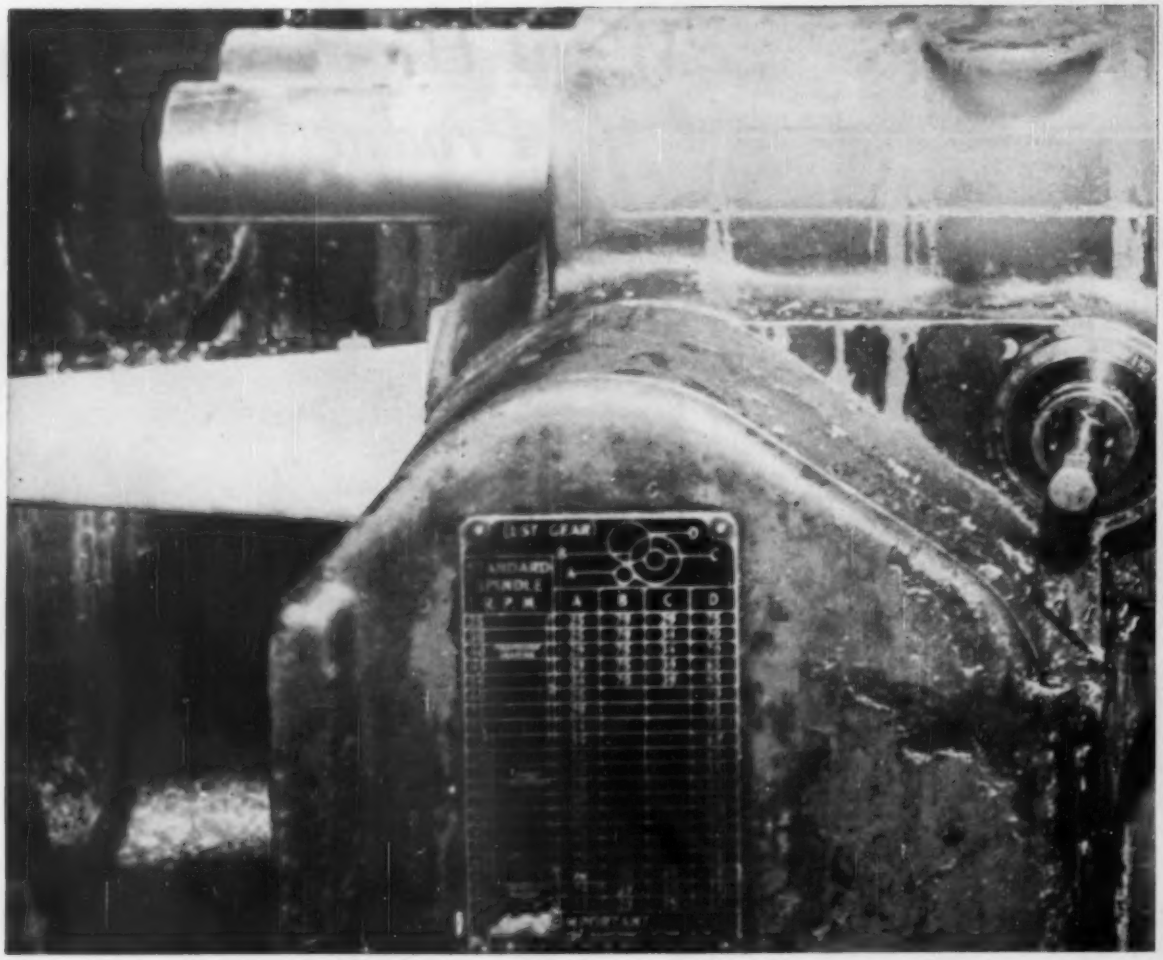
There are many more plus values. These economical furnaces are designed for operation with all types of standard atmospheres. An automatic non-loading belt take-up mechanism adjusts belt tension without reducing useful belt loading. A small water-cooling chamber next to the hot zone can be readily removed for maintenance or replacement due to rapid oxidation.

Harper Mesh Belt Furnaces are available with or without alloy muffles. Matching preheat furnaces are also obtainable. For full information write for Bulletin 454 to Harper Electric Furnace Corporation, 33 River Street, Buffalo 2, New York.

*Nickel alloy elements available for lower temperature applications.

HARPER ELECTRIC FURNACES

For Continuous Brazing, Sintering, Wire Annealing, Bright Annealing, Annealing, Forging and Research



100% Efficiency Was Fine

What % Increase in production can you make by using

ANTISEP

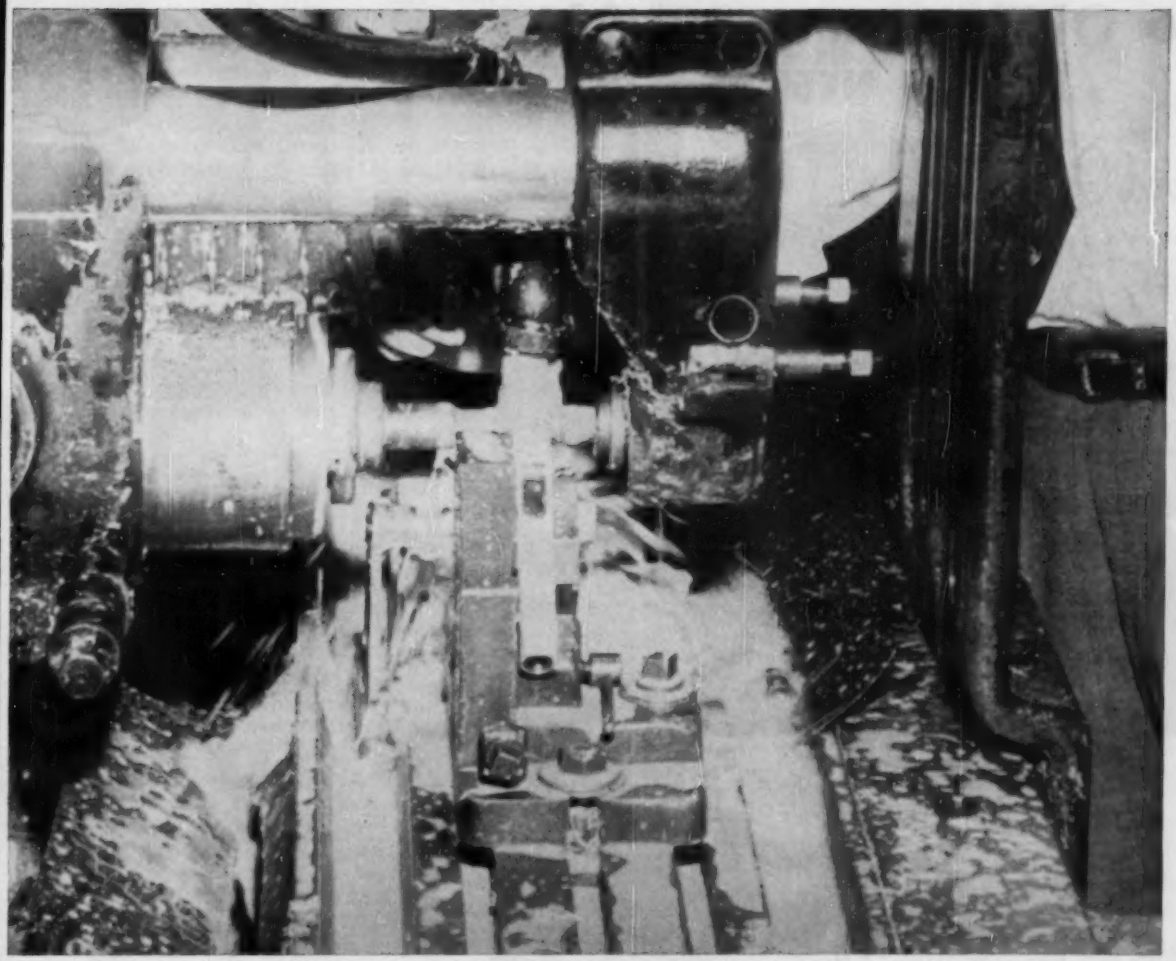
All-Purpose Base?

...the results will be worth a test

It's hard to improve on 100%, but we did. The Houghton Man was right. Of course, we really only *thought* we were getting *all we could* from our machines. But ANTISEP All-Purpose Base made such a difference when we made our initial test that we placed an order immediately.

Mixing ANTISEP 1:20 parts water gives our machining work better cooling and greater lubricity than any oil-base product we ever used. And the result is faster cutting. Nuisances like smoke, rancidity and chip build-up are eliminated. The most surprising fact in the switch-over to ANTISEP is that we actually realize a cost saving, too!

You can get finish quality that is limited only by the fullest capabilities of tool and machine. To be sure that you're really getting your 100%-plus efficiency, try ANTISEP. The Houghton Man offers ANTISEP Base as one of a complete family of superior cutting oils and bases. He has a fine background to help you get more from your machines. Call him in.



Until He Said It Could Be 115%

HOUGHTON'S FAMILY OF CUTTING OILS AND BASES:	
Cut-Max	Series of fortified ready-to-use cutting oils and concentrated bases for dilution by user.
Antisep All-Purpose Base	Miscible with either water or oil; for 90% of all machining uses.
Hocut	Transparent water-soluble coolant.
Antisep Soluble Grinding Oil	Antiseptically treated; detergent action; releases grinding dust.
Houghto-Grind 50	Grinding concentrate; stops rust, won't load wheel.
M. M. Honing Oil	Beats kerosene for honing.

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WHITE CELLULOSE
MICRO-KLEAN®
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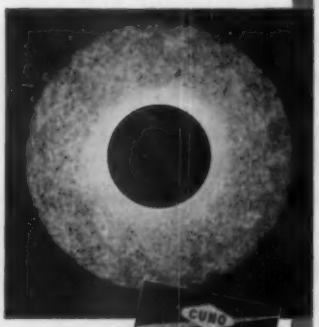
5-MICRON FILTRATION . . . removes *all* particles down to this size *and* a large percentage of particles down to 1 micron or smaller.

COMPLETE SANITATION . . . for water, liquid food processing and other applications where *clarity, purity* and complete absence of any filter-imparted *taste* are essential.

EXCLUSIVE "GRADED DENSITY" construction makes entire depth of cartridge body available for micronic filtration . . . *doubles* cartridge life, cuts replacement costs *in half!*



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There is a Cuno Field Engineer located in your area. To help solve your design problems, this trained specialist offers you *more years of experience* in removing *more sizes of solids* from *more kinds of fluids.*

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Filtration Engineers in Principal Cities

L Day Co, Buffalo engineer, designer, and builder of special machinery. He was formerly associated with Republic Stamping & Enameling Co.

W F Newbery, sales director of Detrex Chemical Industries, has been appointed vice president in charge of industrial sales.

T M Hunter has been named assistant to the vice president of operations, US Steel Corp. **A T Duff** succeeds Mr Hunter as general superintendent of Irvin Works, and **G P Carson** takes over Mr Duff's former duties as assistant general superintendent.

Leonard Sax, secretary-treasurer of American Buff Co, Chicago, has been elected president of the concern.

Donald L Blessing has been appointed general manager of the metal products division of Modglin Co, San Fernando, Calif, subcontractor of airframe components. He was formerly in charge of purchasing for Convair's F102 and F106 programs.

Albert J Reichers, plant manager of Cooper Alloy Corp's (Hillside, NJ) Stainless Engineering & Machine Works Division, has been made plant manager of the Aircraft Products Divisions. **Richard G Wall,** general foreman, takes over Mr Reichers' former post.

Frank M Ryan, vice president of Norton Behr-Manning Overseas Inc, Worcester, Mass, is in Japan as a member of a US Department of Commerce Foreign Trade Mission. In addition to discussing mutual trade problems with leading Japanese businessmen throughout the country the six-member panel will staff the information center at the official US Central Exhibit at the International Trade Fair to be held in Tokyo May 5 to 19.

OBITUARIES

George A Fyrberg, production manager of Norton Co's Abrasive Division, died April 6.

G Donald Spackman, 61, vice president, operations, Lukens Steel Co, died April 14.

Allan J McDonell, 75, president and founder of McDonell Metal Manufacturing Co, Ltd, Canada, died recently there.

Lapping For Precision Flatness and Parallelity in Production Quantities

...with a LAPMASTER

This is the machine for you if you want precision flatness in production quantities at low cost. Lapmasters readily lap to the extreme close tolerance of one light band (.0000116") or less. In addition they produce an extremely fine finish to as low as 1 RMS. They are available with 12", 24", 48", 72" or 84" lapping plates.

THIS IS HOW THE LAPMASTER WORKS

I, a heavy cast iron lap plate revolved slowly under power. **II,** large cast iron conditioning rings are held in position and rotate freely on the lap. **III,** work pieces are placed inside the conditioning ring where they also rotate on the lap. **IV,** a liquid vehicle containing fine loose abrasive flows on the lap plate and is uniformly distributed under the work pieces. At the same time the rotating conditioning rings preserve the flatness of the lap plate. These three essential features, combined with the rapid cutting action of loose abrasive produces a flatness which meets every production requirement.

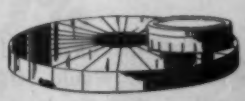
1 Operator requires no previous lapping experience.

2 Lapping with loose abrasive and without excessive pressure eliminates heat and subsequent distortion.

3 Simplicity of design provides accessibility and allows ease of loading and unloading.

4 Loose abrasive distributed evenly over lapping area insured uniform results.

5 Precision laps identical parts in one cycle or parts of various shapes, heights and materials in one cycle.



6 Lap plate always kept in condition while in operation. No down time required for truing or reconditioning.

Learn more about the possibilities of production lapping and the interesting subject of measuring flatness. The illustrated fact-filled booklets are yours for the asking. Write today.

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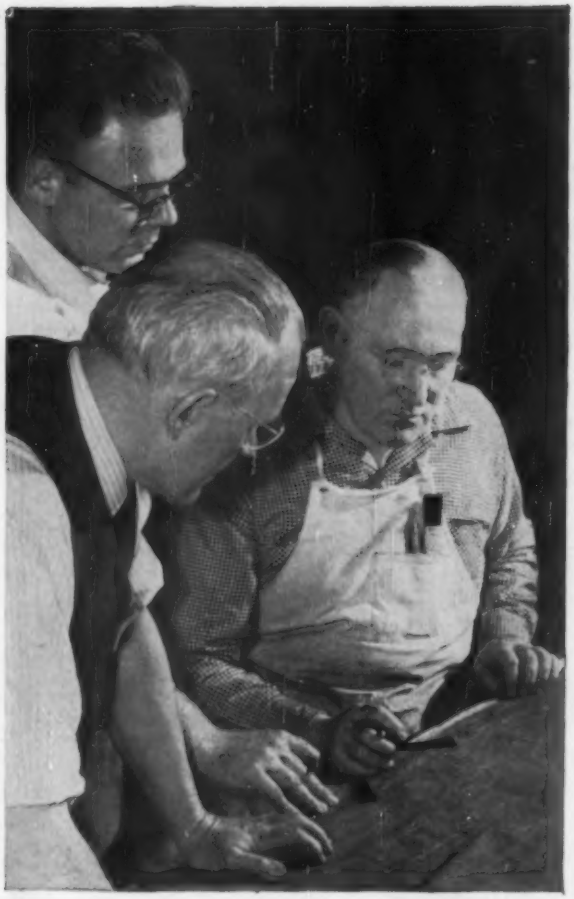

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Faced with a special tooling job? Stymied by a tough problem? Would 50 years of experience help? Then the logical answer for you is to send it to Columbus Die-Tool! CDT specializes in tools, jigs, fixtures and also special machinery, designed and built to produce your products better, faster, and more economically.

That's why so many of the nation's leading manufacturers avail themselves of the specialized services of Columbus Die-Tool. Perhaps CDT can solve your tooling problem and help you make your product . . . better for less.

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THIS is No Ordinary Power Hack Saw Blade

This is the *unbreakable* MARVEL High-Speed-Edge Hack Saw Blade—the first bi-metal blade—invented, developed and introduced by MARVEL. This blade was developed to cut any material from the free machining steels to the toughest alloys, fast, accurately and economically. Just one type blade to handle any job—no switching blades to cut different materials.

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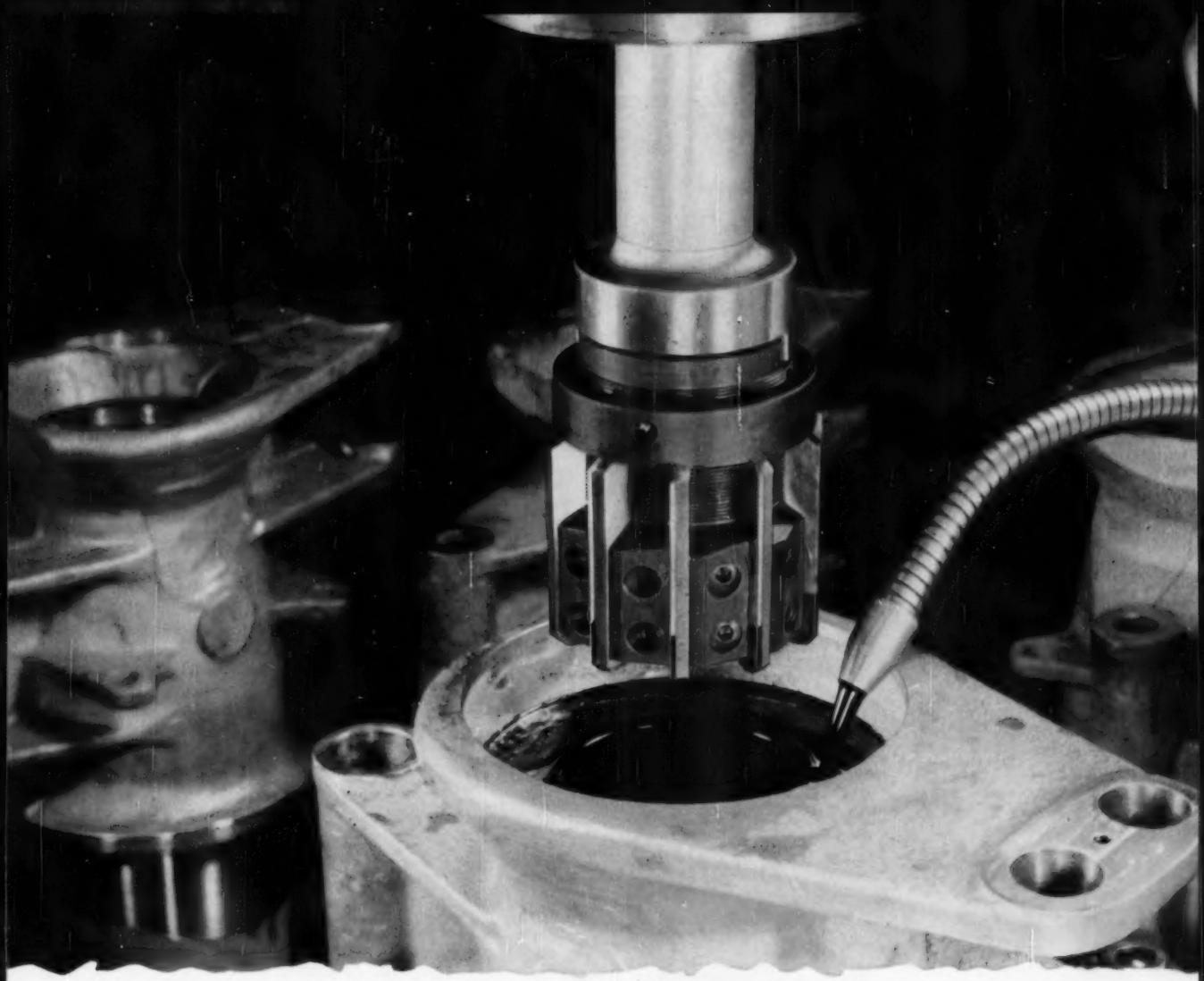

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CLEVELAND Carbide Tipped Adjustable Reamer sets new high record!

The specifications on this job call for reaming a 4½" hole to a tolerance of .001" and a surface finish of less than 50 R.M.S. (micro-finish). CLEVELAND Carbide Tipped Adjustable Reamers are meeting these requirements day after day... month after month... *and reaming five times as many holes per grind as the conventional high speed reamers formerly used.*

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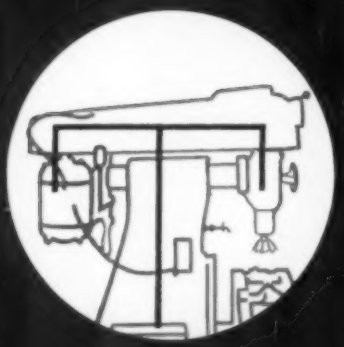
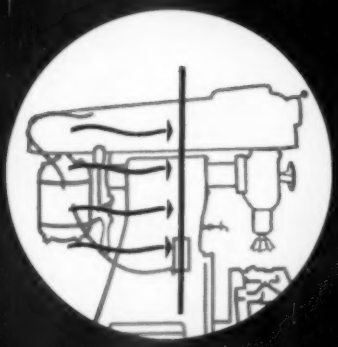


Motor mounted behind column balances weight of head, minimizes deflection.

ISOLATION OF MOTOR VIBRATION



Column acts as baffle, keeping motor vibration away from head.

MORE EFFICIENT POWER TRANSMISSION

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1881 CAPEWELL

power hack saw blades

THE USER: Edgcomb Steel Company, Philadelphia, Pennsylvania
THE MATERIAL: High Speed Steel Billets
THE JOB: Maintaining precision-true hack sawing
THE PROBLEM: Uneven cuts and excessive blade breakage
THE ANSWER: Capewell Safetech Power Hack Saw Blades
THE RESULT: Power hack sawing now a routine operation—no more production headaches.

Edgcomb Steel Company chose Capewell's shatterproof Safetech blade for this long, heavy job because they could get more cuts per blade, quickly and economically under heavy feed, while providing complete operator safety. Other Capewell power hack saw blades are Technite and High Speed—each of these all-hard blades is designed to give proved maximum sawing performance.

You, too, can improve your production by standardizing on Capewell Power Hack Saw Blades. Tooth by tooth, you'll find that Capewell blades are a superior product, manufactured to rigid specifications, so that you can be assured of blades that stay sharper longer.

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CASE HISTORY NO. 37—TIMING GEAR HOUSINGS

MATTISON
HIGH-POWERED PRECISION

GRINDING METHODS

Courtesy: Allis-Chalmers Mfg. Co.

Bigger loads, faster setup on surface grinder doubles production of parts formerly milled!

Production was boosted from 5 to 12 parts per hour by switching this job to a Mattison No. "400-SS" Vertical Spindle Reciprocating Table Surface Grinder. The workpiece is a diesel engine timing gear housing that is first rough-ground to within .010 inch on both sides and then finish-ground on the same machine. Flatness and dimensional tolerances are easily maintained within commercial limits.

Practical elimination of setup time is a big item in getting this increased production. Most parts have only to be laid flat on the magnetic table, fixtures are not needed in most cases. Seven castings, like those shown, can be finished at one time.

An extra-long and heavy column, rigidly fastened to the base, and a 60, 75, or 100 hp spindle motor are features which speed metal removal and increase accuracy on the Mattison 400 Series Vertical Spindle Surface Grinder. Arrange for a test grind on your parts in the Mattison Methods Laboratory.

Shaded portion of timing gear housings, at left, is removed in two-pass setup on Mattison 400-SS grinder. Finished workpieces are at right.

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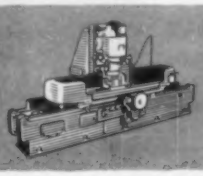

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Production Up—Engineers at the Milwaukee Works of International Harvester Company have adopted TOCCO for hardening final drive gears for famous International Harvester farm tractors. TOCCO increases production on the gear shown here from 14 to 35 per hour, 250% faster than conventional heating method, reduces job from a 3 shift to 2 shift operation, even with increased production schedule. Heating time is 35 seconds; oil quench, 60 seconds.

Costs Down—TOCCO cuts cost—saves $82,507 per year on application shown above. TOCCO makes possible use of C-1050 A.R.R. steel instead of expensive A-8645-H alloy steel previously required. TOCCO also eliminates shot-blast, formerly needed to remove scale, and extra machining operations that used to be necessary to compensate for distortion.

Gear shown is 18½" O.D., width of face is 2", weight 34 pounds, 73 teeth. Hardness obtained is 55-66 R.C., using 140 K.W. of 10,000 cycle power.

Our Engineers can probably find applications in your plant where TOCCO can increase output and reduce unit costs.

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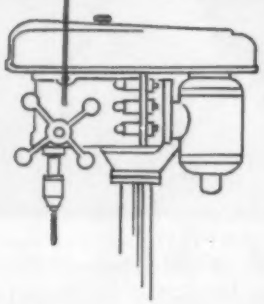

Like to know more about it?

These two free booklets tell the entire story. Write for them today. Address: Dept. AM-557, The Bellows Co., Akron 9, Ohio. In Canada: Bellows Pneumatic Devices of Canada, Ltd., Toronto, Ontario.

There are more hand fed drill presses in use than any other machine tool. They are all pretty much alike. The operator positions the work in a jig or fixture, feeds the drill in and out of the work by turning a star wheel by hand, and removes the work from the jig.

A good workman can drill a clean hole. But not too many of them. It's a tiring job. Towards the end of the shift both quality and quantity suffer.

Let's put a Bellows Drill Press Feed on the star wheel shaft. Now, the operator touches a lever. Automatically the drill is fed in and out of the work, under perfect control. Production is increased 20%-30%; quality is better; tool life longer.

Let's go a step farther. Add a Bellows Rotary Feed Table. Now all the operator has to do is load parts. The table automatically positions the part under the drill. the drill press feed automatically feeds the tool, the table indexes to eject one part and position another. Production is more than doubled, often more than tripled.

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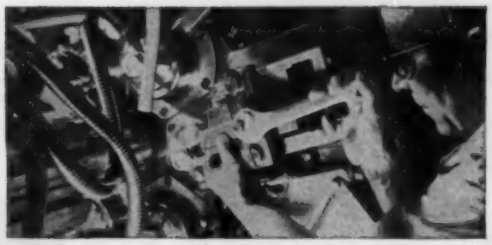
For more detailed information or metallurgical assistance, write or call our nearest District Sales Office today—or write directly to our General Office.

One of the most important operations in producing Elastic Stop nuts from Youngstown Cold Finished Bars. Here the bar is being cut to length to form the basic nut blank. Six spindle screws of the Automatic drill and ream the tap hole, cut and form the unclosed crown, drill and ream the insert well and finally, cut off the finished nut blank. The cold finished bar's quality must not vary as any hidden seams, pipes or center segregations could cause tooling and production breakdowns.



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HOW FLASH-BUTT RESISTANCE WELDING IS USED TO FABRICATE PRESSURE VESSELS

Severe test program proves Sciaky techniques of resistance welding provide the safe welds necessary for assembling butane gas containers

In a program undertaken to determine the metallurgical advantages of flash-butt welding for joining half shells of butane gas containers, Sciaky has established the suitability—and superiority—of the process for this application. The flash-butt process offers a 100% strength factor compared to 80% for flame or arc welds.

Job Description

Figure 1 shows the half shell and the assembled container. The metal is deep drawn low carbon steel. The

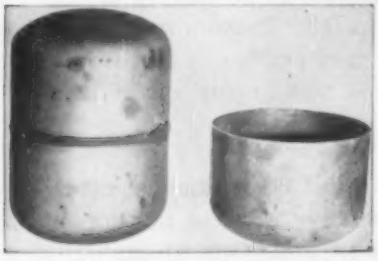

Fig. 1 At the right is a single half shell. At the left are the half shells joined by flash welding, flash not removed.

half shell has an I.D. of 11.6" and an O.D. of 11.8" or a cross section of 3.63 sq. in.

Special clamps were developed so that the clamping pressure could be applied to a maximum surface of the parts to be welded. End and side views of the clamp arrangement are shown in Figure 2.

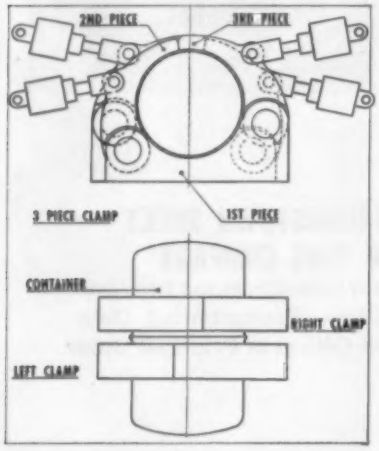

Fig. 2 Clamps for joining half shells.

The welder is a 300 KVA Sciaky Flash-Butt Welder with an upsetting force of 25,000 psi. Current is supplied to both the upper and lower clamping dies in order to assure uniform distribution throughout the diameter. One platen is fixed and the other movable. The flashing system is pneumatically operated and flashing time controlled by an adjustable metering valve.

A wedge cam provides the proper platen acceleration for flashing. A tap switch affords sixteen steps of heat regulation. Copper alloy clamping dies are used as locators and also serve as back-ups for the piece parts during the upsetting.

Test Results

The safety of the flash-butt welds was extensively tested under hydraulic pressure. Two such containers are shown in Figures 3 and 4 and for comparative purposes a fusion welded container in Figure 5.

Extensive metallurgical tests were also conducted from which the following conclusions were drawn:

1. Flash-butt welding makes it possible to obtain a strictly autogenous weld. This is true because the weld is made without the addition of extraneous material, and because the upsetting action displaces the melted base metal and impurities at the weld joint.
2. The flash-butt process makes it possible to obtain a joint having the same consistency on the inside and on the outside of the containers. See the macrographs, Figures 6 and 7.

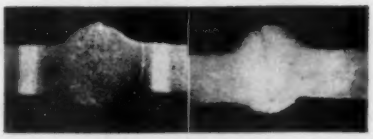

Fig. 6 Macrographs of flash welds before (left) and after annealing. Note consistency on both inside and outside.

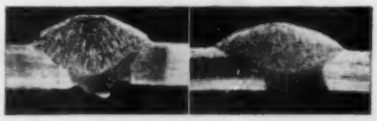

Fig. 7 Macrographs of arc welds before (left) and after annealing. Note irregularities on inside due to lack of penetration of extraneous material.

Complete Report Available

A complete, detailed report with extensive illustrations and the results of additional tests is available without charge. Please write on your company letterhead asking for the *"Engineering Report on Resistance Welding of Butane Gas Containers."* There is no obligation.

Fig. 3 Flash welded and annealed container which burst at 1349 psi. Weld elongation was 29.6%.

Fig. 4 Flash welded and annealed container which burst at 1278 psi. Weld elongation was 24.3%.

Fig. 5 Fusion welded and annealed container which burst at 994 psi. Weld elongation 11.6%.

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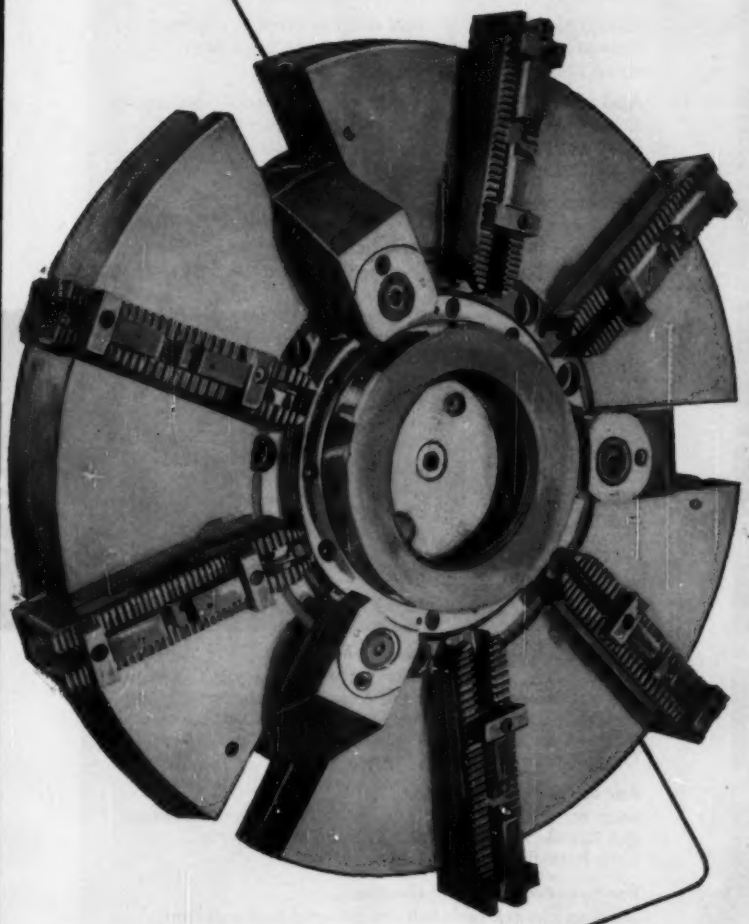

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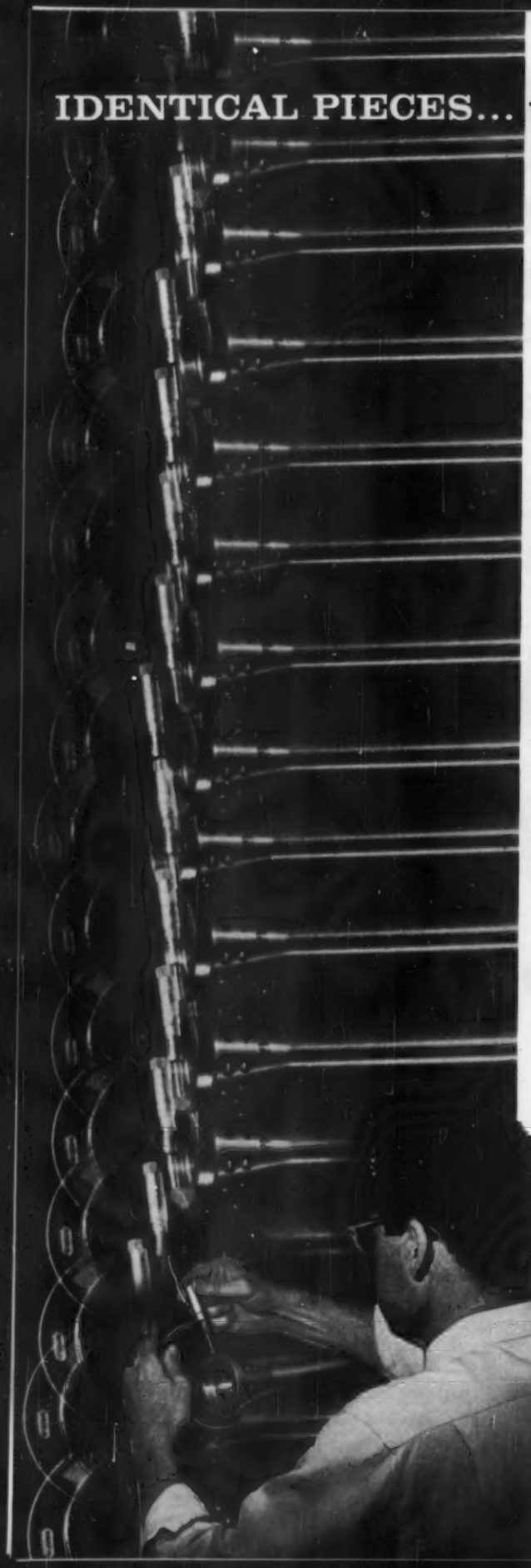

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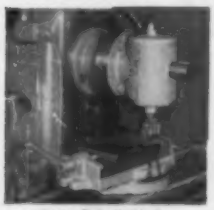

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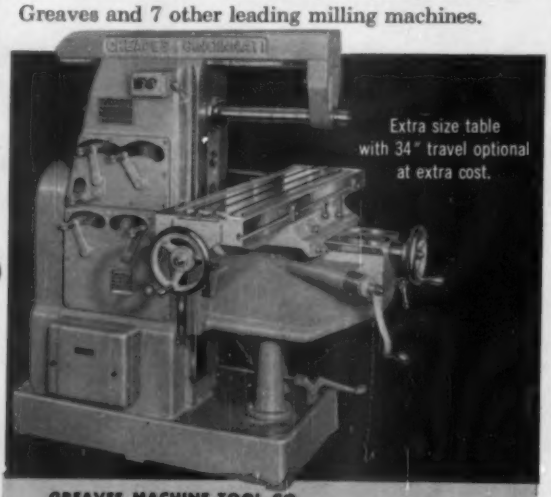

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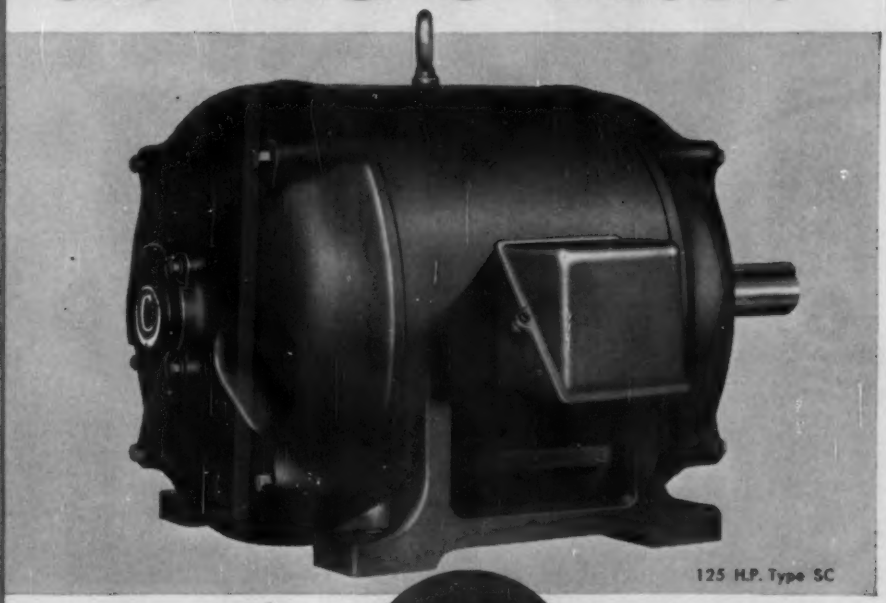

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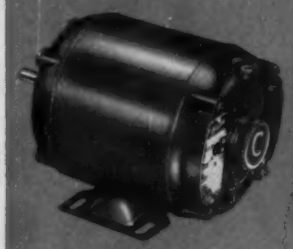

WHATEVER YOUR APPLICATION THERE'S A Century MOTOR

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You'll get the top performance your equipment's designed for... because there's a motor *designed for it* in the Performance-Rated Century line.

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Let us prove the value of Performance-Rating for you... without obligation. Call or write your nearby Century District Sales Office or Authorized Distributor.

Performance-Rated© MOTORS 1/20 to 400 H.P.

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Pick exactly the right steel for any job from J & L's complete cold finished line

steel whorl production increased 22% with J & L LEADED STEEL

Superior uniformity and machinability of J & L 1113 Leaded Steel enabled this manufacturer to increase production from 110 to 140 pieces per hour. J & L Leaded Steels give you higher cutting speeds, longer tool life, improved finishes. Call your local distributor or write to Jones & Laughlin, 3 Gateway Center, Pittsburgh 30, Pennsylvania.

J&L STEEL

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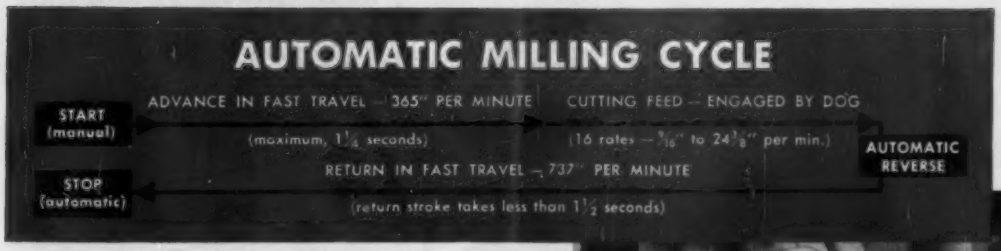
. . . a great name in steel

MACHINING PERFECTION always starts with the right steel

The BROWN & SHARPE No. 000 – with the


AUTOMATIC MILLING CYCLE
START (manual)
ADVANCE IN FAST TRAVEL – 365" PER MINUTE
(maximum, 1¼ seconds)
CUTTING FEED – ENGAGED BY DOG
(16 rates – 3/16" to 24⅜" per min.)
AUTOMATIC REVERSE
STOP (automatic)
RETURN IN FAST TRAVEL – 737" PER MINUTE
(return stroke takes less than 1½ seconds)

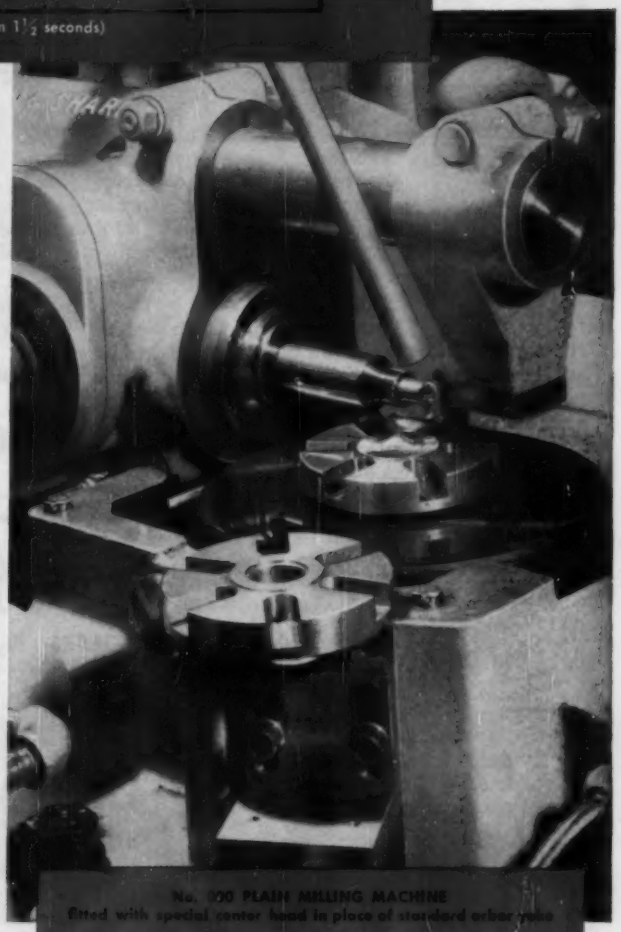
Special machine productivity with unlimited adaptability

Set up with conventional work-holding equipment, the Brown & Sharpe No. 000 Plain Milling Machine is the reliable pace-maker for rapid production milling of small parts.

For exceptionally long runs, fixtures of special design further increase the basic high-production potential of the No. 000. Such fixtures provide automatic indexing, continuous loading with automatic clamping, and other forms of automation, with record savings in milling cost.

With a special fixture on a standard machine, you get the high-speed production advantages of an expensive single-purpose special machine. You save on equipment cost and you avoid the risk of costly obsolescence due to later changes in product design. The unlimited adaptability of the basic machine permits easy conversion to revised operations, or other jobs.

Brown & Sharpe specialists in fixture design will survey your operations and make recommendations at your request. Let them show you how to make your investment in production milling equipment pay the highest return in savings. For complete information, write: Brown & Sharpe Mfg. Co., Providence 1, R. I.



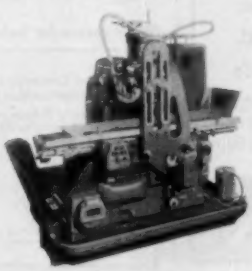
No. 000 PLAIN MILLING MACHINE
fitted with special center head in place of standard arbor yoke

SPECIAL AUTOMATIC INDEXING FIXTURE
Operator loads fixture and starts machine. Cycle continues until final cut . . . then machine stops automatically.
Cutter — Special carbide-tipped angular milling cutter 1¼" dia.—held in special collet
Part Turret indexing plate Material C1120 Steel
Operation Mill 83 radial notches on face of hub
Cutter Speed 835 rpm Feed Rate 24⅜" per min.
Production 10 PIECES PER HOUR

Heavier production units powered for the larger work size range

No. 12 PLAIN MILLING MACHINE

3, 7½, or 10 HP Spindle Drive

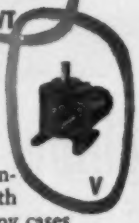


The home of PRECISION CENTER B·S

Brown & Sharpe

MILLING, GRINDING, AND SCREW MACHINES • CUTTERS
MACHINE TOOL ACCESSORIES • PRECISION TOOLS • PUMPS

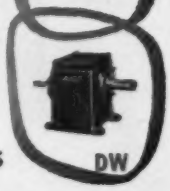
Grant Speed Reducers



YOUR ASSURANCE OF BETTER PERFORMANCE

The *real* criterion for reduction units is unfailing performance over the years, with minimum maintenance. Our files show many cases where Grant Reducers are still providing every-day service, after two decades, without a breakdown.

What's back of such performance? Extra-quality features built into each Reducer, by gear experts . . . totally enclosed cast iron housings, radial thrust ball bearings, precision high-test bronze gears and worms of chrome vanadium steel. These features mean money in your pocket through trouble-free operation.



Grant manufactures a complete range of types and sizes — worm, double worm, compound worm and spur, helical and mitre gear — with reductions up to 3660-1 — most available from stock. Write for the latest catalog, describing each type in detail.

STOCK GEARS SPECIAL GEARS

SPEED REDUCERS

GRANT GEAR WORKS INC.

Founded in 1877 by George B. Grant, the Pioneer Gear Man

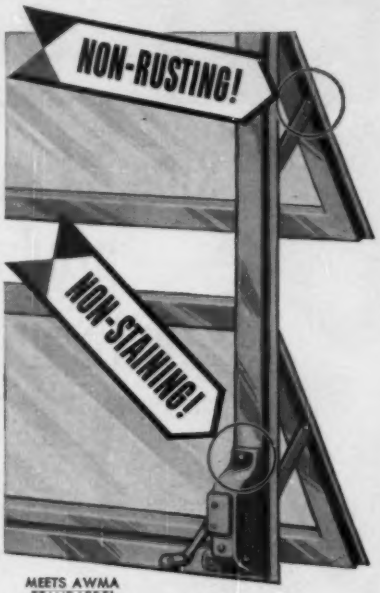
169 WEST SECOND STREET BOSTON 27, MASS.

WANT TO TOOL WITH PLASTICS?

American Machinist's Special Report Number 410 outlines the plastics most widely used; the new materials now available; and the new toolmaking techniques that are being developed. Case histories illustrate current applications of these methods in Metalworking. Send 25¢ and your name and address to:

Reader Service Department
AMERICAN MACHINIST
330 W. 42nd St., New York 36, N. Y.

How Alcoa Aluminum Fasteners make good windows even better



MEETS AWMA STANDARDS!

You can meet the highest standards of quality and the specifications of the AWMA (Aluminum Window Manufacturers Association) for prime windows of aluminum when you assemble with Alcoa® Aluminum Fasteners. Perfect color match and protection against both galvanic and atmospheric corrosion make for lasting good looks . . . consumer satisfaction. Complete stocks carried by your local Alcoa distributor fill every requirement. He is listed in the Yellow Pages of your telephone directory.

ALCOA ALUMINUM FASTENERS

Your Guide to the Best in Aluminum Value

THE ALCOA HOUR
TELEVISION'S FINEST LIVE DRAMA
ALTERNATE SUNDAY EVENINGS

Fill out coupon for facts, samples

Aluminum Company of America
2238-E Alcoa Bldg., Pittsburgh 19, Pa.
Gentlemen: Please send complete specification data and samples of Alcoa Aluminum Fasteners.

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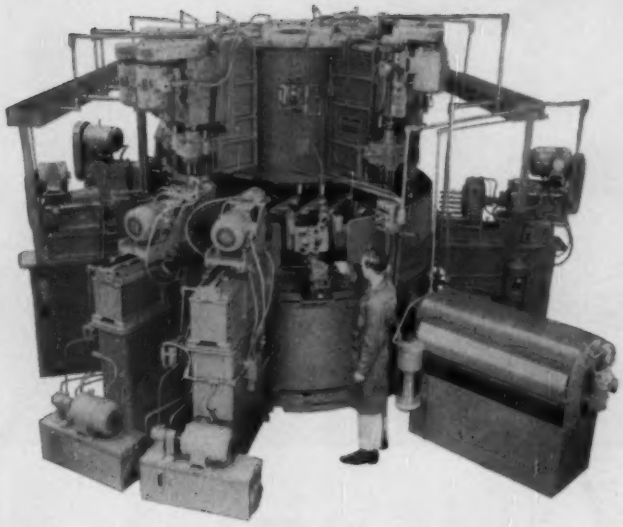
Eliminates model change-over problems!

a production machine—with standard units—quick change-over features—for each year's design change. completely automatic—requires only part loading and unloading.



18 STATIONS · 47 OPERATIONS 120 PARTS / HOUR

The new intricate production giant shown above is also a triumph in metalworking flexibility. Designed for a leading appliance manufacturer, the MORRIS Model 334-S High Production Machine processes one-cylinder or two-cylinder housings at the rate of one every 30 seconds.

Yet there's no model changeover problem! The MORRIS completely automatic "special" machine uses a MORRIS basic center column machine equipped with an 84" dia. table, an 18-station automatic hydraulic index, and MORRIS Unit-Type Machine Tools.

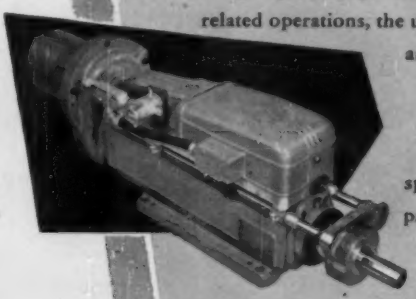
A total of 47 spindles, mounted on three 8-inch way type units, six No. 2 CAM-MATIC Drill Units and eight AIR-OIL-MATIC Drill Units, are used to mill, drill, counterbore, spot face, bore, ream and tap housings. The result is . . . a special machine at a fraction of the usual special machine cost . . . accurate, flexible, fast!

Write for new detailed descriptive literature . . . or outline your mass production problem involving drilling or related operations for prompt attention by MORRIS engineers.

MORRIS AIR-OIL-MATIC DRILL UNITS

- Adjustable Feed, Stroke and Rapid Approach
- Trouble-free Hydraulic System
- Wide Range of Spindle Speeds
- Convenient Controls
- Air or Oil Powered
- Hydraulically Controlled

Designed for a wide range of drilling, reaming, chamfering, spot-facing, hollow milling, centering and related operations, the unit can be mounted in vertical, angular or horizontal positions. Controls may be set to provide almost any sequence of operation. Available for use in special purpose machines like the production machine illustrated.



New Available equipped for GUN DRILLING

with infinitely variable spindle speeds and feeds; speeds to 8000 rpm, feeds to 40"/min. with 6" or 9" stroke. Sliding base available for 6 or 9" movement. Write for details.

Morris

THE MORRIS MACHINE TOOL CO.

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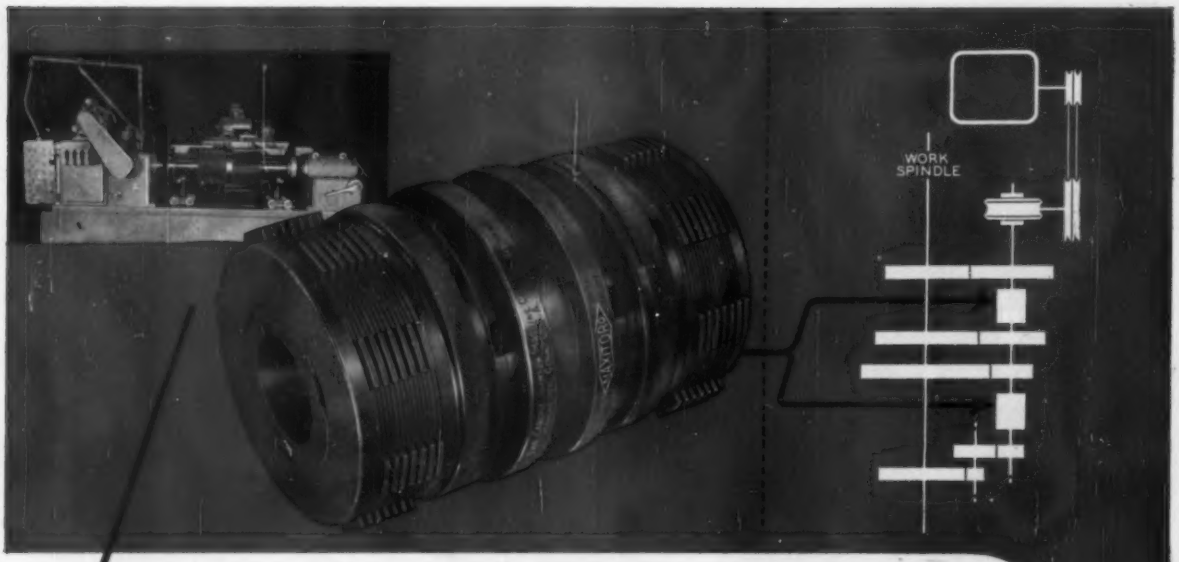


how Maxitorq Floating disc clutches

helped MICHIGAN TOOL design push-button speed and versatility into new "king-size" gear shaver

The two MAXITORQ Double Clutches tucked so compactly into the main-drive gear-box on Michigan Tool's Model 885 Gear Shaver permit simple, positive, finger-tip selection of four speed ranges, infinitely variable, with a low of 1.3 to a high of 166.4 r. p. m. They are an important key to this new machine's outstanding features of versatility, speed, quick change-over, and push-button control.

Machine tool and industrial equipment designers find in MAXITORQ Floating Disc Clutches the essentials of COMPACT design and instant positive engagement and disengagement . . . freedom from drag or heating in neutral and full power transmission . . . that are so important to the success of installations such as these. MAXITORQ Floating Disc Clutch design and *performance* have been PROVED by many years of service under all conditions.

Outstanding advantages of MAXITORQ Floating Disc Clutches for machine tool and equipment drives also include RUGGED SIMPLICITY of all parts . . . MINIMUM EFFORT for engagement and disengagement . . . EASY MANUAL assembly, disassembly and adjustment. Available in a full range of sizes in SINGLE, DOUBLE and AUTOMATIC OVERLOAD RELEASE types.

For full information, write Dept. AM-5.

THE CARLYLE JOHNSON MACHINE COMPANY

Manchester, Connecticut

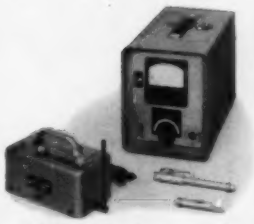
PRODUCTION INSTRUMENTS FOR SURFACE CONTROL

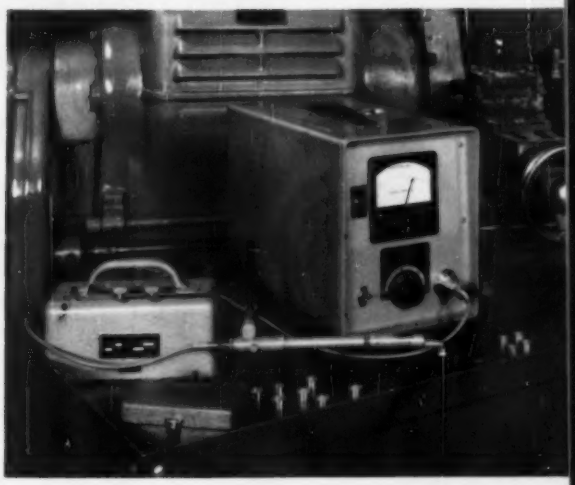
More and more companies are obtaining better quality of products and better production economy through greater knowledge of the surfaces that they produce.

The four production instruments shown on these pages *provide* that knowledge, through numerical measurement of important surface characteristics. Thus, these instruments permit the *specification* and close *control* that are essential to the above-named benefits.

1. *For measuring surface roughness . . .*

THE PROFILOMETER®



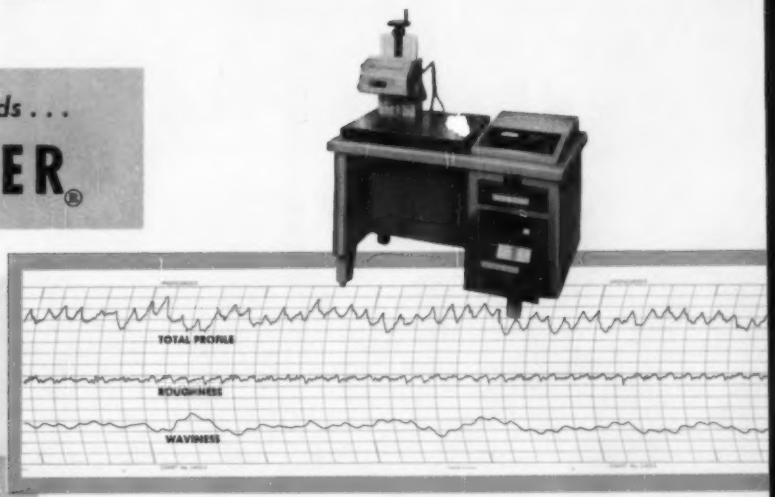


THE PROFILOMETER measures the roughness of practically *all* machined and finished surfaces — internal and external — in standard microinch units. It gives *consistent, accurate readings* for *any* surface from polished glass to rough-machined forgings. It is fast and simple to operate — can be used wherever desired — and is standard equipment in *thousands* of production and inspection departments, throughout the world.

BULLETIN LT14 gives details, and describes cost-saving applications.

2. *For obtaining surface profile records . . .*

THE PROFICORDER®



Profile records of the same surface (¼ actual size) showing total profile, roughness profile and waviness profile.

THE PROFICORDER provides a chart record of the magnified profile of internal and external machined and finished surfaces. It records (1) the total profile, including roughness and widely-spaced irregularities, (2) waviness, bows, steps, etc., with roughness omitted, or (3) roughness irregularities alone, as desired — with a wide choice of magnifications. The charts show the *height* and *spacing* of the irregularities, and open up new possibilities in production set-up, inspection and control, and in research and development work.

BULLETIN LT24 gives details and specifications.

MMC

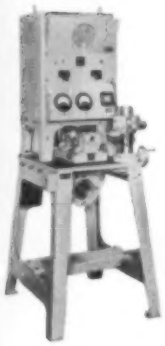
MICROMETRICAL MANUFACTURING COMPANY

Pioneers in Surface Measurement . . Since 1936

SEE WAVOMETER® and ANDEROMETER® on other side

3. For measuring waviness around surfaces of rotation . . .

THE WAVOMETER®



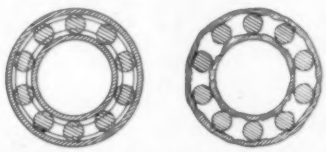
THE WAVOMETER measures the waviness around internal and external surfaces of rotation on a production basis. This instrument (1) gives meter readings of the average height of the waves in two wave-bands, in microinches; (2) shows on an oscilloscope the general shape and spacing of the waves in either wave-band; and (3) permits nicks, scratches and deviations in quality to be detected by means of a loudspeaker.

BULLETIN LT10 explains the causes and nature of waviness, and describes the Wavometer in detail.

4. For measuring the over-all quality of assembled ball bearings . . .

THE ANDEROMETER®

WITH ALL BALL BEARINGS, the balls and raceways have surface irregularities of widely-varied height and spacing. When a bearing is in use, these irregularities of contour produce a complex cam action that results in noise and vibration.



These drawings show an *ideal* ball bearing (left) with geometrically-perfect balls and races, and an *actual* bearing with surface irregularities greatly enlarged radially. These irregularities cause radial movement when bearing is running.

The Anderometer *measures* this characteristic, in units called *Anderons*, on a meter for each of three measurement bands, while the bearing is running under thrust load. Thus, the Anderometer enables ball bearing users to write definite *numerical specifications* for bearing quality. It also provides for *checking* bearings against those specifications by a *dependable, unbiassed instrument*, in production and receiving inspection.

BULLETIN LT11 gives details. An Anderometer technical bulletin is also available.

WRITE FOR FREE LITERATURE on all of these instruments that are of interest to you.

Profilometer, Proficorder, Wavometer and Anderometer are registered trade-marks.

MMC®

MICROMETRICAL MANUFACTURING COMPANY

345 S. MAIN ST., ANN ARBOR, MICHIGAN

CABLE: MICROMET

Form LT25 — 4-57-100

Printed in U.S.A.

here's how Seeburg matches P-K® fasteners to the job

And Parker-Kalon's wide range of types and sizes makes it possible

"By carefully selecting the right P-K screw for each assembly we've reduced rejects and stepped-up production," says Joseph Kamys, engineer of J. P. Seeburg, manufacturers of the famous line of Select-O-Matic "200" Coin Operated Phonographs.

◂ "Take the fastening of metal kickplates and base moldings to wood cabinets, for example. They must hold permanently and go in fast without splitting the wood. P-K Type-A Self-tapping Screws are just right for the job."

"In a metal-to-plastic application such ▸ as the fastening of high-frequency speakers to formed plastic housings—P-K Type-Z thread-forming Screws go in right without cracking the plastic—stay put, even under high vibration."

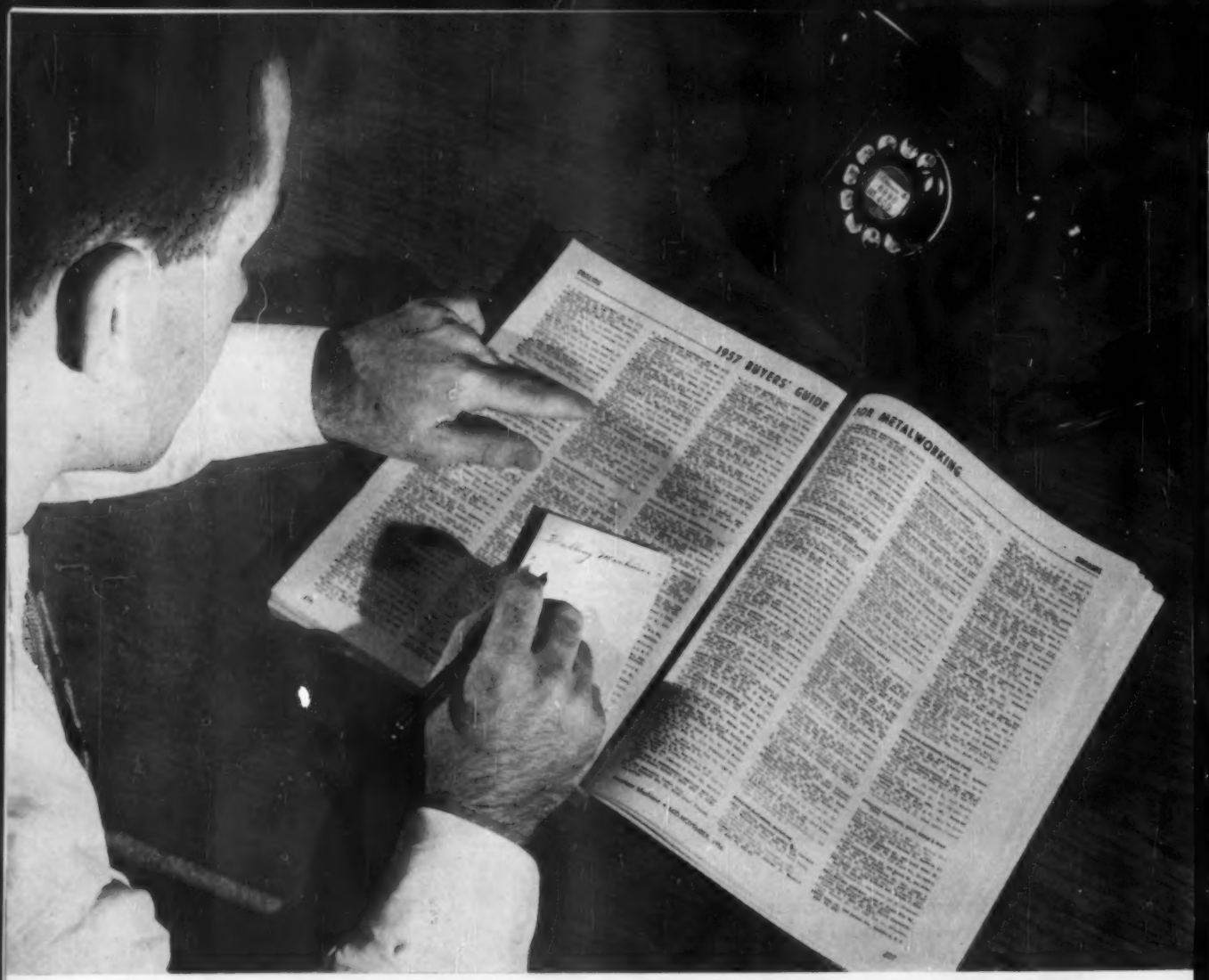
◂ "In this important subassembly, appearance is important as well as dependable holding power. Here we use P-K Type-A Phillips Recessed Head Screws in a metal-to-metal application."

Whatever your product or application . . . ferrous or non-ferrous castings, sheet metal or structural steel, plywoods, asbestos compositions, pliable or brittle plastics . . . Parker-Kalon can furnish the proper fastener to speed assembly, reduce rejects, cut costs!

PARKER-KALON®
fasteners

Sold Everywhere Through Leading Industrial Supply Distributors.

***PARKER-KALON DIVISION,** General American Transportation Corporation. Factory: Clifton, New Jersey.*



Wondering who makes . . . BEARINGS? . . . GEARS?
. . . FASTENERS? . . . GRINDERS?
. . . or any of the 1001 operating items and machines you need?

Here's an up-to-date single volume buying guide and production aid—

AM's Production Planbook and Buyers' Guide Issue

New York—If you refer frequently or occasionally to the Buyers' Guide section of your 1957 Production Planbook and Buyers' Guide Issue published by AM in Mid-November, 1956, you are right in line with 93% of recently surveyed American Machinist subscribers.

Of those answering the question, 70.3% refer to the Buyers' Guide Section "occasionally" or an average of 2.5 times monthly; while another 21.7% use it "frequently" averaging 2.8 times per week. 88.7% of respondents state they refer to the advertising pages for product information.

Over 7000 Sources of Supply—1400-plus Headings

Typical listings in 107-page Buyers' Guide Section. Names of advertisers in the issue are shown in bold face with page numbers of advertisements, for easy reference by subscribers wanting full product information.

Readers' Comments

Many subscribers added comments to the questionnaires they returned. Samples:

"Your 1957 Production Planbook and Buyers' Guide issue is better this year than I ever saw before. It is very well arranged in all departments, and with the addition of the Buyers' Guide, it makes a good year 'round book and I am very proud to own it." *Plant Manager*

"We have found this 'Guide' very useful to an extent that it is our 'first source' when looking for information." *Superintendent*

"Your Buyers' Guide is of particular interest at this time as we are soon to move into a new plant with some new machines and tooling." *Production Controls Supervisor.*

"A very informative publication that is extremely helpful especially in regard to the Buyers' Guide Section. An up-to-date Section such as this is always of great value with the ever changing products and markets of today." *Factory Manager*

"Information contained in the issue pertaining to types of machine tools, general descriptive data as well as the manufacturer's identification and address often aids to expedite the gathering of initial ideas for further development." *Works Supervisor*

"Consider having advertisers take a page to list their distributors so buyers can find them and not accept substitutes." *Consultant*

"I find it very helpful as a source for new equipment such as valves, hydraulic cylinders, relays. Also as a reference for a source of material specified by customers when designing new projects." *Production Supervisor*

1958 Edition Now in Preparation

And here's good news: AM's *1958* Production Planbook and Buyers' Guide Issue will be published in *Mid-September, 1957,* to reach you just in time for Fall-Winter production planning.

You'll find 11 idea-stimulating sections treating everything you need to plan ahead for a high-production-level 1958—all wrapped up in a manageable, single volume, working reference issue.

Flat-opening, thumb-indexed and classified by topic, American Machinist's 1958 Production Planbook and Buyers' Guide Issue is easy to use and refer to throughout the year.

Exclusive Editorial Features

Production "Nuggets" — declared highly useful and enthusiastically endorsed by 4 out of 5 surveyed subscribers — are the essence of production ideas classified by subject matter, and, for ready reference by subscribers who want more specific details, drawings, and diagrams, issue dates and page numbers of the source are included.

***"Names in the 'Nuggets'"**—lists of the various trade names and company names appearing in the "Nuggets" sections to help you take quick action on production ideas, stimulated by the "Nuggets."

"Developments to Watch in '58," found useful by 90.5% of surveyed subscribers, provides you with a handy check-list against which you may rate your shop procedures and requirements, as compared to the latest production ideas and techniques.

Manufacturers Free Literature — lists of helpful literature offered by manufacturers, classified by type, following each "Nugget" section.

A Year-'Round Ready Reference

All these features will appear in appropriate sections as shown at right—provide an additional, unique editorial service without extra charge to subscribers—make American Machinist's 1958 Production Planbook and Buyers' Guide Issue an authoritative, complete ready reference of

How-to-do it
What-to-do-it-with
Where-to-buy-it

you will want to refer to the year 'round.

1958 OUTLOOK
MANAGEMENT, PERSONNEL A
MACHINING B
TOOLING C
PRESSWORKING, MOLDING, CASTING D
INSPECTION, TESTING, QUALITY CONTROL E
ASSEMBLY, HEAT-TREAT, FINISHING, (ASSEMBLY INCLUDES WELDING & PORTABLE TOOLS) I
MATERIALS, COMPONENTS G
MATERIALS HANDLING, SERVICES H
PRIZE IDEAS, REBUILT EQUIPMENT
BUYERS' GUIDE J

81-Block
REFERENCE SET

VK "*Quality in Millionths*"

VAN KEUREN
RECTANGULAR GAGE BLOCKS

Thirty-eight years of experience in manufacturing gage blocks plus the finest in modern measuring instrumentation produce the *"Quality in Millionths"* evident in VK rectangular gage blocks.

These gages are the end product of many skills developed over a long period of time. Final accuracy is controlled by absolute measurement of our master standards on the latest design Zeiss Interferometer, and by comparison with masters calibrated by Interferometry at the National Bureau of Standards, Washington, D.C. VK gage block measurements are made in a modern Gage Room in which temperature is held to 68° ± .1°F. Surface finish is inspected by a Zeiss Interference Microscope.

Van Keuren rectangular gage blocks are offered in Class A (± .000004") and Class B (± .000008") accuracy. They are guaranteed for length, flatness, parallelism, surface finish, hardness and stability. A certificate showing the exact size of each block is furnished with all Class A sets.

The tolerance on VK microgages has again been halved, and all microgages are now furnished to +.000008" −.000000", at no increase in price. Tolerance is all plus to provide necessary wear allowance on working blocks.

VK MICROGAGES

Set M35L Price $120.00

For "working" gage blocks we recommend VK ⅞" diameter microgages in the new Class "A" (+.000008" −.000000") accuracy. These gages are available in 16 sets, including the 35 block set shown above, and the valuable set M81 at $250.00.

VK

38th YEAR

THE Van Keuren CO.

173 WALTHAM STREET, WATERTOWN, MASS.

Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers . . . Gage Blocks . . . Wire Type, Taperlock and Trilock Plug Gages . . . Master Setting Disks . . . Thread Measuring Wires . . . Gear Measuring Wires . . . Carbide Plug Gages . . . Carbide Pivots . . . Precision Lapping Service.

You can get the *custom designs* you want from a basic Skinner Solenoid Valve

In the small-size solenoid valve field, Skinner offers a wider variety of variations and optional features than any other manufacturer. Take, for example, the standard V5 model shown above in cutaway form. Its design is so flexible that the valve can be supplied for applications which would otherwise call for "specials." So, if you have a solenoid valve problem, we urge you to talk to a Skinner representative. Tell him your requirements in regard to port sizes and locations, voltages, pressures, temperature conditions, flow adjustments and mountings. Let him show you how easily he can select the valve you need.

When you specify Skinner, you get custom design plus outstanding service performance. Continuous testing in our labs and actual results in the field prove that Skinner valves have exceptional leakproof life. For complete information on Skinner's line of 2-, 3- and 4-way valves, write us or contact a Skinner representative. Write Dept. 305.

Skinner Solenoid Valves are distributed nationally

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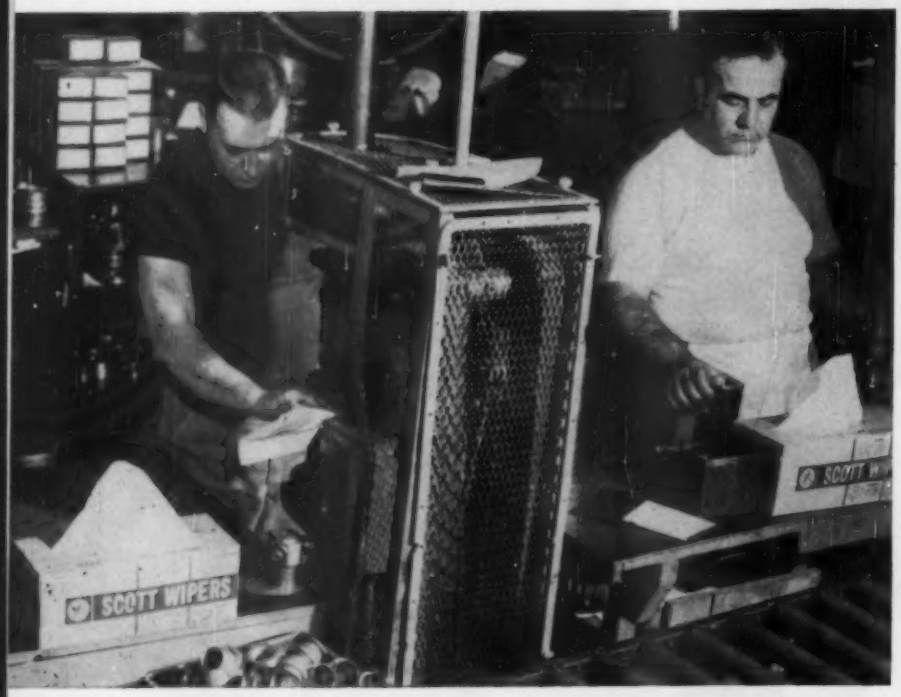
THE CREST OF QUALITY

SKINNER ELECTRIC VALVE DIVISION

NEW BRITAIN CONNECTICUT

105 EDGEWOOD AVENUE



At BCA, soft, absorbent, 2-ply Scott Wipers are used to wipe machines, tools, finished parts, hands, faces. They're lint-free, chemically treated for proper wet strength, and Perf-embossed® . . . a special process that gives thorough cleaning action, speedy absorption.

WIPER PROBLEM? Look what BCA did with Scott Wipers!

Precision ball bearings made by Bearings Company of America, Division of Federal-Mogul-Bower Bearings, Inc., are used world-wide in cars, trucks, tractors. They are produced on automatic screw machines. Scott Wipers were put on trial in BCA's plant, under these stipulations:

Scott Wipers were to be tried in place of cloths. The paper wipers would be adopted if acceptable to machine operators and inspectors . . . if they helped to solve the housecleaning problem . . . if they were found safer to use and if there was a cost saving realized.

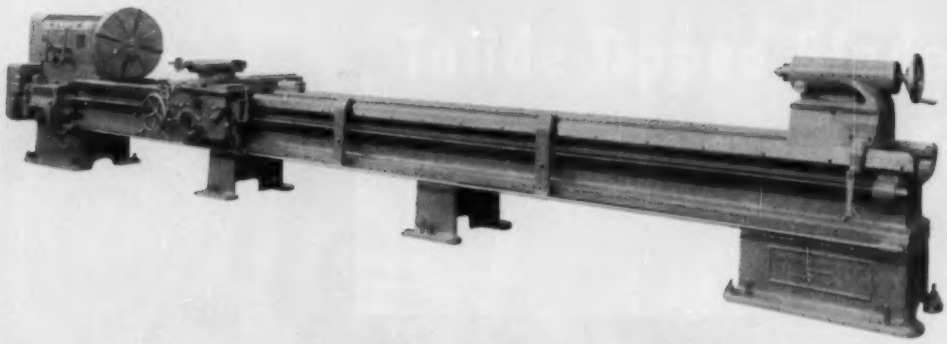
Results: employees preferred Scott Wipers,* the plants were kept cleaner . . . Scott Wipers fresh from a box were sanitary . . . carried no metallic particles to scratch or cut . . . and Scott Wipers saved BCA at least $71 a month—*not* including savings resulting from eliminating hidden costs of handling, weighing, storing and dispensing cloth wipers!

Want to see improvements like this in your plant? Call your Scott man today or write Scott Paper Company, Department AM-75, Chester, Pa.

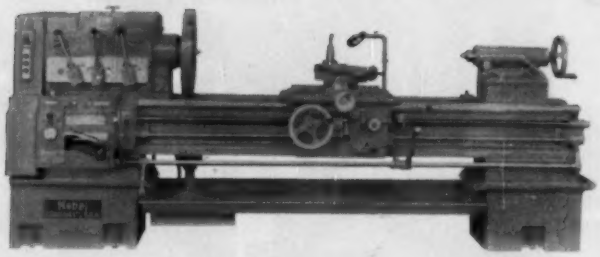
SCOTT PAPER COMPANY

Makers of the famous Scott paper products you use in your home.
Consult your local TV schedules for Scott's program, "Father Knows Best."

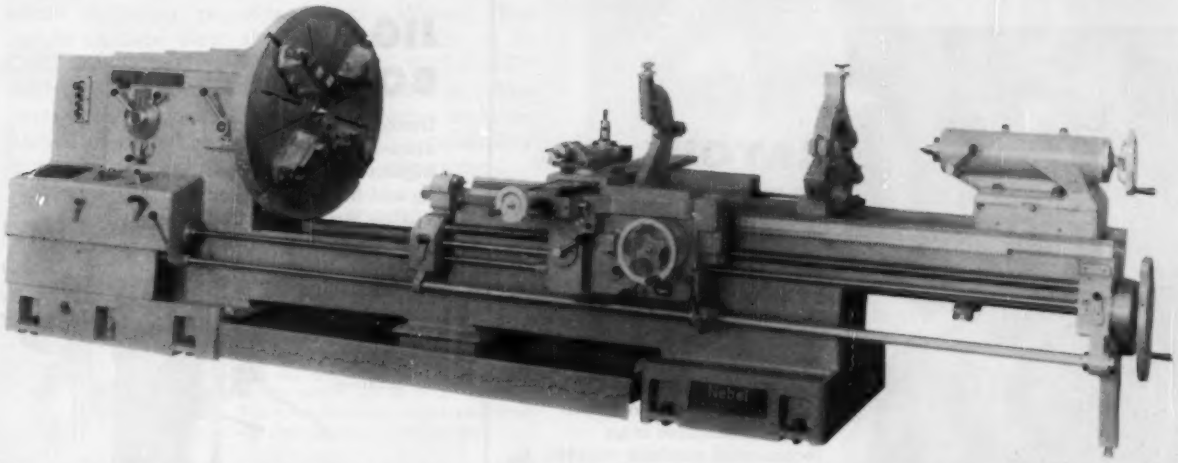
*Patent Pending



need a 40" lathe? what's the cost?



use a 20" lathe, too? what'll you pay?



buy this lathe and get the capacity of <u>both</u> at less than you pay for a 25" heavy duty!

This is for you. If you turn a variety of work (chucking and between centers), the Nebel XB 20"/40" heavy duty extension bed gap is your best lathe investment. It offers the capacity of two ordinary lathes.

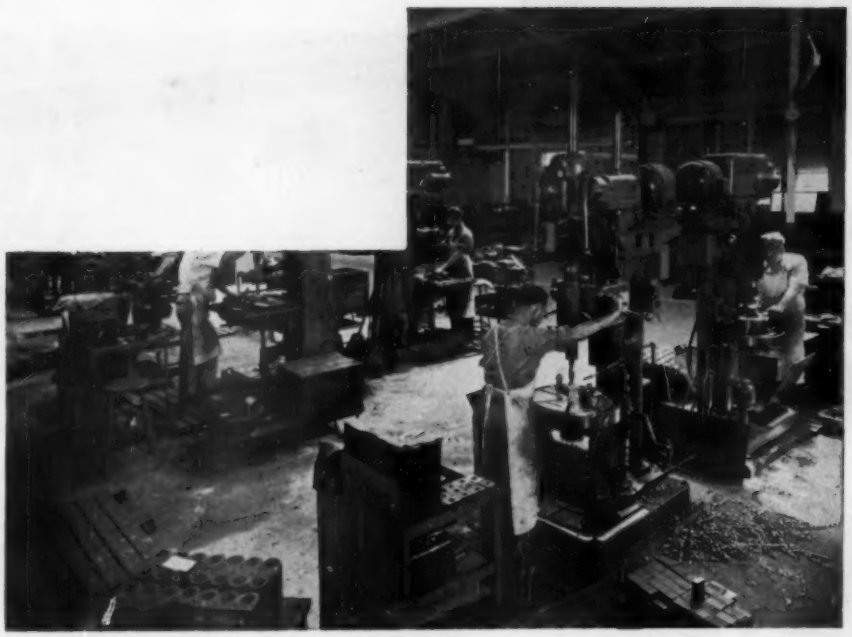
Other double-duty Nebel extension bed gap lathes: G 28"/50" heavy duty and AG 20"/40" medium duty. Removable block gap lathes in three swing sizes; standard lathes in six sizes 16" to 36".

Learn how you can double your turning capacity with just one investment—in a lathe that occupies the floor space of but one machine. Send for descriptive bulletins. Nebel Lathe Div., Nebel Machine Tool Corp., 3407-A Central Pkwy., Cincinnati 25, Ohio.

Nebel
LATHES
CINCINNATI

DRILLING MACHINES

A battery of box column and round column Cleereman Drilling Machines on production work. One of many such installations producing at lower costs with higher production, less operator fatigue and no down time.

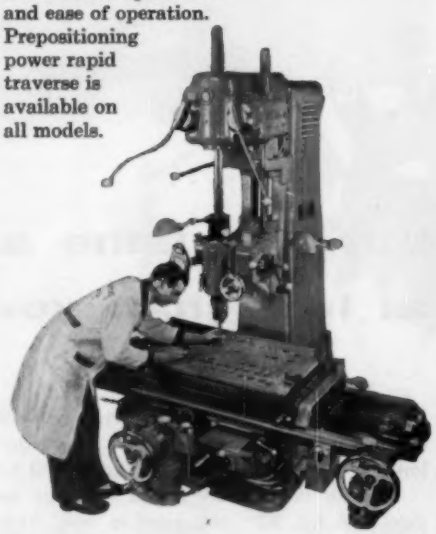


LAYOUT DRILLING MACHINE

A modern solution to an old problem. Built for those tool room and manufacturing jobs which do not require the ultra precision of Cleereman Jig Borers. The Cleereman Layout Machine is an economical machine capable of locating within .001″ per foot and drilling, boring, reaming, tapping, etc., with utmost operator ease at a fast rate of production.

JIG BORER

Unexcelled precision for ultra-fine tolerances on highest quality gage, tool, die, jig and fixture work and on "jigless" production. Combines stamina with precision and ease of operation. Prepositioning power rapid traverse is available on all models.



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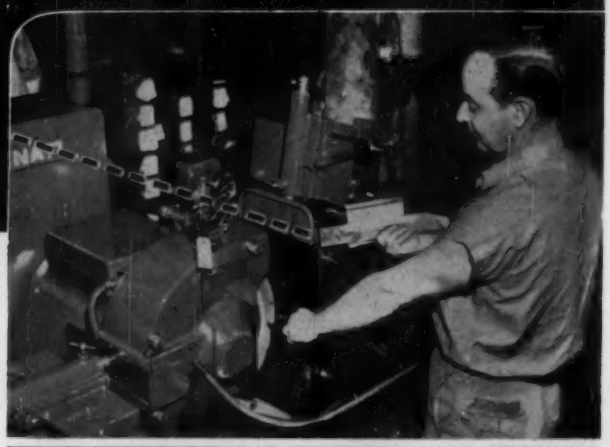
CLEEREMAN MACHINE TOOL CORP., Green Bay, Wis.

Talide-Tipped Blades on the job for over 10 Years!



SPS

STANDARD PRESSED STEEL CO.
JENKINTOWN, PENNSYLVANIA

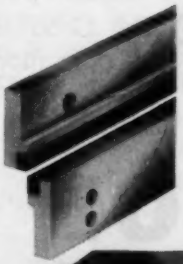
world's largest producer of socket screws, has been a regular user of Talide-tipped centerless grinder blades for the past 10 years. SPS centerless grinders are equipped with super-hard Talide centerless blades, enabling millions of precision parts to be centerless ground without downtime for blade changing, regrinds or replacements. The Talide carbide wear strip is produced by us in ONE SOLID SECTION UP TO 100" IN LENGTH WITHOUT SEAMS. A solid carbide wear strip has been proven more efficient than shorter sections brazed or butted together because the possibility of marking or scoring the work is eliminated.

TALIDE ROTARY KNIVES GIVE PHENOMENAL RUN OF 90-1...

A leading strip steel producer of razor blade, high-carbon, spring and stainless steel reports over 1200 coils were gang slitted with Talide knives compared to 15 coils with steel knives. More tonnage was produced in one regrind of the Talide knives than over the entire life of a set of steel knives. Burr-free, clean-cut edges produced with scrap rate practically eliminated.

$18,000 SAVED USING TALIDE SHEAR BLADES!

A large electric motor manufacturer shearing .014" silicon steel for transformers advises first year savings of $18,000 in blade costs after completely equipping their press line with Talide-tipped blades in lengths ranging from 15" to 87". Talide shear blades are averaging 1,000,000 cuts per grind compared to 10,000 cuts obtained with steel blades.



Over 50 sizes and styles of standard blades carried in stock—with special blades made promptly to order. Write for 76-page catalog 56-G or ask for sales engineer to call.

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Youngstown 12, Ohio

EXCLUSIVE RETIPPING SERVICE

Because of its exclusive hot press method, Metal Carbides is able to rework worn, chipped out or broken areas of carbide-tipped blades back to original size and dimension with all breaks and defects eliminated.

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

In 10 short years the Chambersburg CECO-DROP has become the standard gravity drop hammer of the forging industry. Some of the reasons for this astonishing success are these:

1. The Ceco-Drop is a proven tool, the original "Boardless Board Drop Hammer," with world wide acceptance.

2. More than 400 Ceco-Drops are in service in 119 forge shops all over the world. Many companies have initiated programs looking toward complete conversion to Ceco-Drops.

3. The Ceco-Drop has created new standards of performance, and established new standards of tolerance in drop forgings.

4. The Ceco-Drop minimizes leg fatigue in drop hammer operation. Hammermen prefer the Ceco-Drop.

5. The Ceco-Drop costs less to maintain, has fewer, more durable parts. Automatic lubrication prolongs parts life.

6. The Ceco-Drop is economical to operate. Air or steam is used only when the hammer is running.

7. The Ceco-Drop forges more minutes per hour. (Once it is set-up, just turn on the air or steam and forge.) It does more forging per blow, requires no board changes, no friction adjustment.

8. The Ceco-Drop is safer . . .The operator's station is clear. There are no overhead hazards. It has fewer, lighter mechanisms. It has a safety dog and safety cylinder cover. Power failure stops the hammer and clamps the ram.

9. The Ceco-Drop requires less die set-up time. Die changes are quicker, easier. It takes but a minute to adjust the stroke.

10. The Ceco-Drop has a wide range of operation due to the unique short stroke adjustment and control.

CECO-DROP

U. S. PATENT NO. 2,604,071, JULY, 1952 . . . OTHERS PENDING
CECO-DROPS HAVE BEEN BUILT IN SIZES FROM 500 LBS. TO 8000 LBS.

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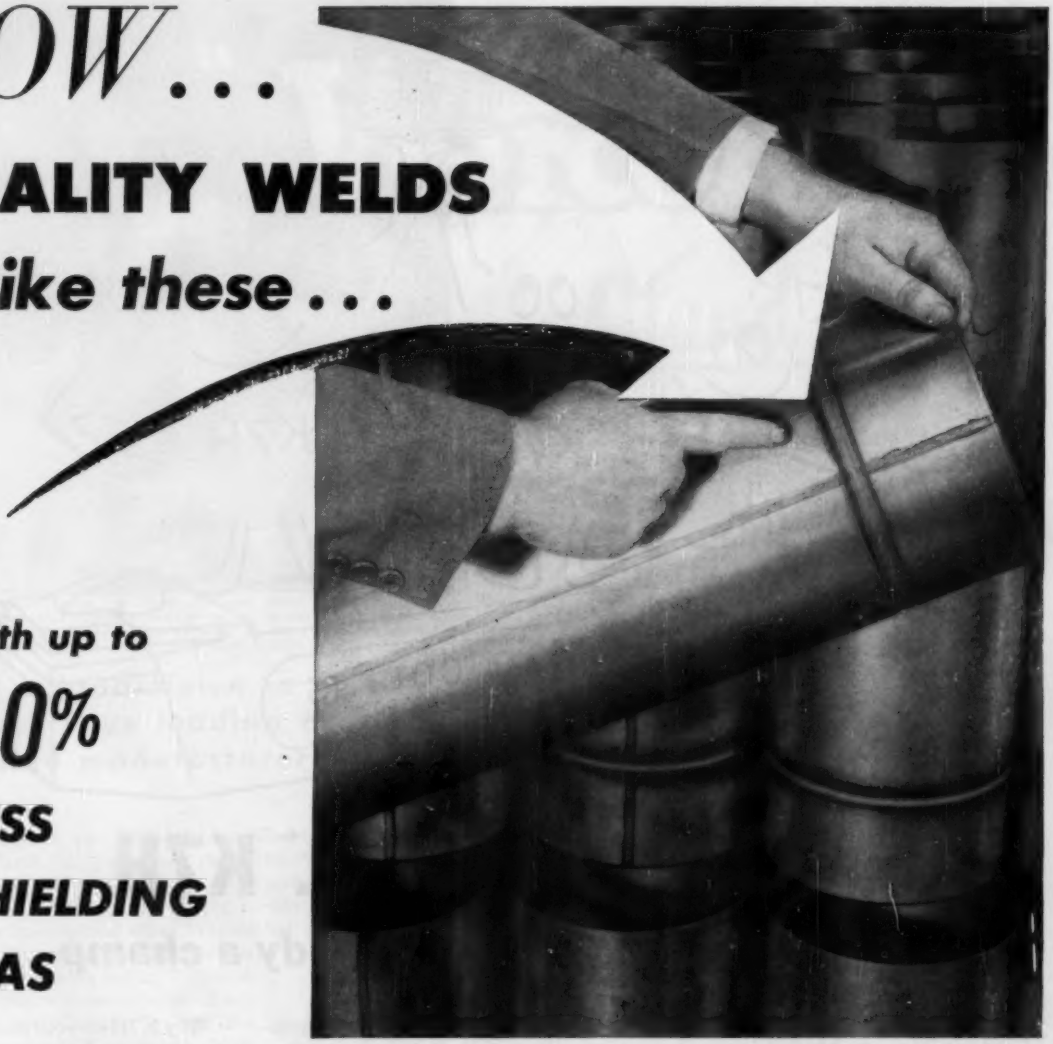

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H-15 argon-hydrogen mixture means new economy in fast, sound welding operations.

Using H-15, a LINDE mixture of argon and hydrogen shielding gases, savings as high as 60% of normal gas consumptions are being attained by manufacturers on a wide variety of metal products. This mixture is designed for extremely efficient mechanized welding of stainless steel, Monel, Inconel, and cupro-nickel.

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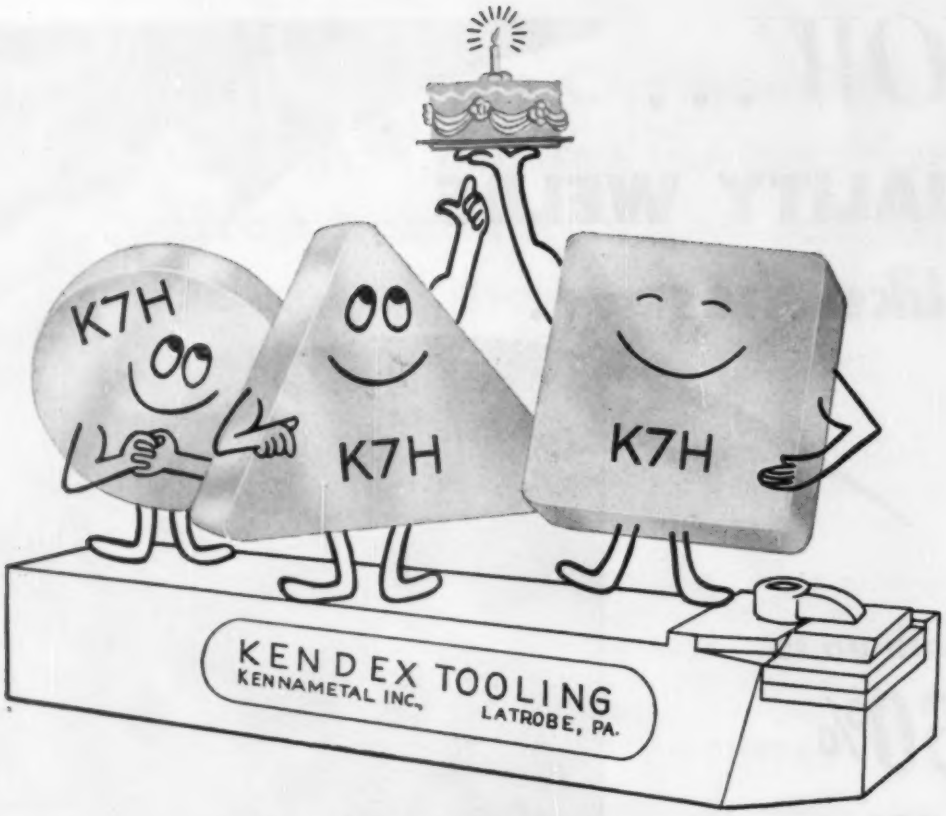


KENNAMETAL* K7H

only a year old but already a champ

After only a year, Kennametal Grade K7H is the proven leader in high velocity machining and in cutting heat-treated and high tensile steels. Its high hardness (93.5 Rockwell A) combined with exceptional strength (three times that of the non-metallics) provides outstanding wear resistance and maximum resistance to cratering . . . high resistance to shock . . . fast cutting and excellent finish.

K7H "throw-away" inserts used with Kendex tooling are improving production and reducing tooling costs over a wide range of applications. Here are a few typical performances:

Production *increased 50%* by substituting K7H on an SAE 8620 forging with a finish cut .060″ deep, 900 sfm, and .018″ feed. K7H machined the same number of pieces per cutting edge as did a competitive carbide at a much slower speed.

K7H cuts *252 pieces as compared to 30* . . . the best record for a competitive carbide in facing cut to dead center of SAE 1018 steel 5″ O.D. gear blank, at 1000 sfm (at outer edge) and .008″ depth of cut.

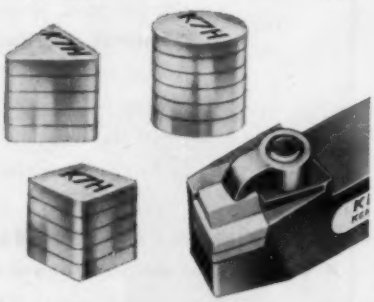
In a carbide evaluation test, the lineal footage cut by K7H was *five times* the best footage machined by any of three competitive grades tested . . . and with less than .005″ wear land. Material used: Halcomb 218 steel, 48 Rockwell C, .030″ depth at .010″ feed.

K7H *maintained excellent surface finish* . . . less than 10 microinch finish in cutting 4340 steel at 1000 sfm; 30 to 60 microinch finish in cutting 1095 steel at 1500 sfm.

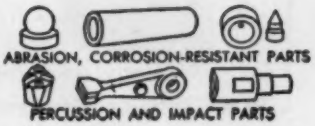
Try K7H on your hard-to-machine materials and high velocity jobs. A Kennametal tool engineer can help you take advantage of this exceptionally strong Kennametal grade. Discuss your machining problems with him. Or write KENNAMETAL INC., Latrobe, Pennsylvania.

*Trademark

C-5033



INDUSTRY AND KENNAMETAL ...Partners in Progress



Tongue support part for New Holland baler, prepared with 75-ton Warco inclinable punch press, is shown fitted in place on Hayliner 68 assembly line at New Holland, Pa. Inspecting the job is Sub-assembly Foreman Lee. Larkin.

"Warco PRESSES ...Stand up!"

"Not a breakdown in five years," says leading farm machine manufacturer

• Several years ago New Holland Machine Company, New Holland, Pa., purchased their first Warco Press . . . an inclinable punch press. It is still working as good as the day they bought it. Since then they have added other Warcos for piercing, blanking and forming a variety of machine parts. "We find these presses very satisfactory," say New Holland officials; "in our five years of using Warcos we have never had a breakdown."

Warco Presses stand up because they are built from the frame out to deliver maximum performance in the most difficult assignments.

Using a 75-ton Warco inclinable punch press, operator Christian Good turns out tongue support parts. Watching the operation is Assistant Foreman Lester Howe. Ten-gauge hot-rolled sheet steel is used for the part.

THE FINISHED PRODUCT... Warco inclinable punch press had a hand in turning out this smart-looking, smooth-performing Hayliner 86 baler. The machine was designed to bring the average-size farm big baling capacity at smaller baler cost.

Federal® WELDERS

The Federal Machine and Welder Company

Warco PRESSES®

WARREN, OHIO

The Newest ACME Model HA THREADING MACHINE

ACME Model HA (heavy duty) Single Spindle Threading Machine 2" capacity.

New **Design**

New **Production Features**

New **Built-in Precision**

New **Versatility**

Wide Speed Range: The Acme Model HA has eight spindle speeds assuring correct speeds for various diameters and materials to be threaded.

Adjustable Carriage: Adjustable both horizontally and vertically to permit alignment with the die head.

Hardened and Ground Ways: Rectangular ways guide and support the carriage insuring precision alignment and smooth carriage travel.

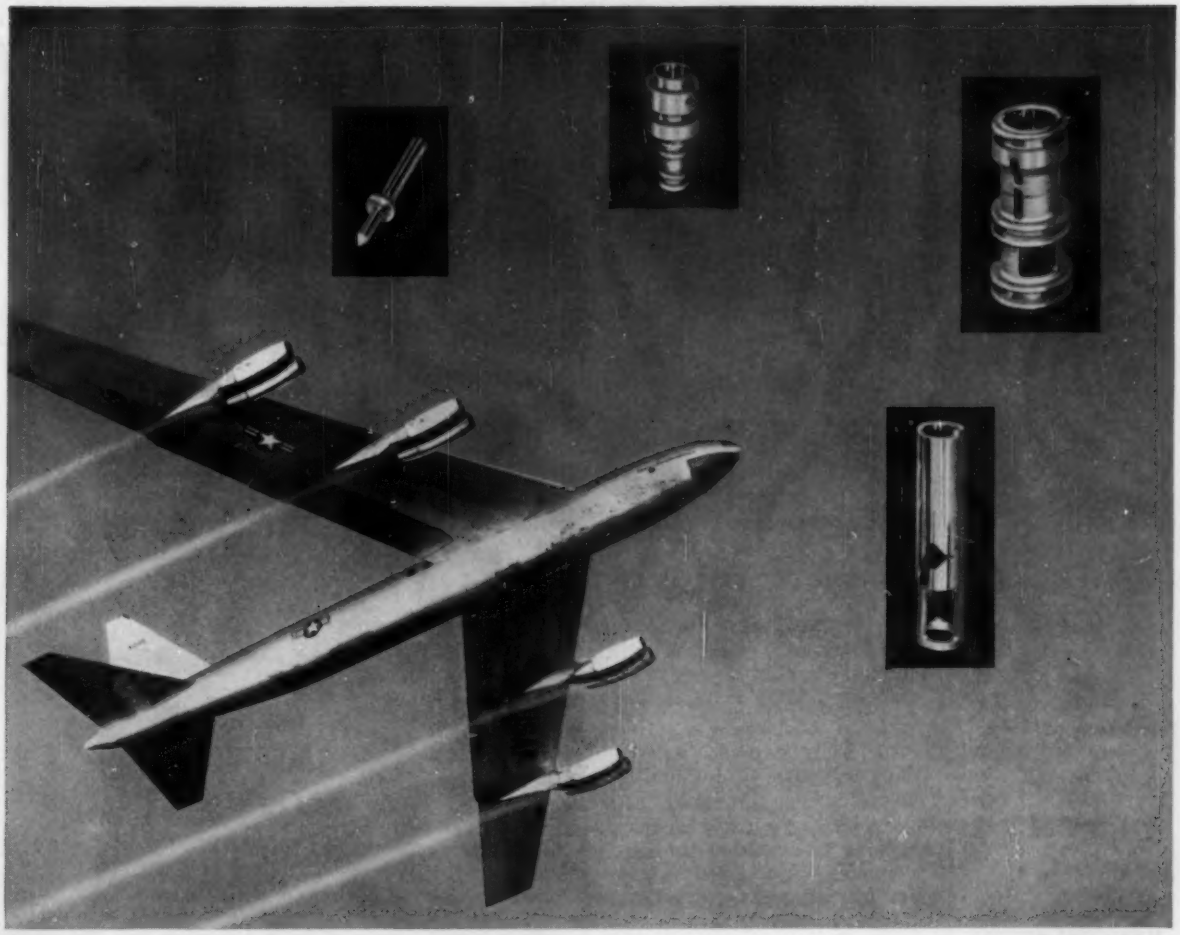
Ask for bulletin HAT giving description and complete specifications.

The Acme Model HA is adaptable to either tangential or hob type die heads using tangential or hob type chasers of standard design. Model HA Threaders are built in 1", 1½", 2" and 2½" capacities in single or double spindle design.

THE HILL ACME COMPANY

ACME MACHINERY DIVISION • **1209 W. 65th St., Cleveland 2, Ohio**
ESTABLISHED 1882

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING & POLISHING MACHINES
HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • "CLEVELAND" KNIVES • SHEAR BLADES



The difference in this stainless makes possible finishes of .000003" on these aircraft parts!

These highly critical parts are used in fuel control systems of America's newest and biggest jet bombers such as the B-52 jet bomber shown above.

Finishes of 3 millionths of an inch are obtained in the machining of these and similar aircraft parts by the fabricator. Carpenter Free-Machining Stainless also enables him to hold close tolerances on complex components. In his own words, ". . . we know we can rely on Carpenter Stainless to hold the dimensions to which the parts are designed."

Why settle for less than this kind of performance from the stainless you use? Call your nearest Carpenter Mill-Branch Warehouse, Office or Distributor now for rush delivery of Carpenter Free-Machining Stainless Steels.

Carpenter STEEL

Free-Machining Stainless Steels

The Carpenter Steel Company, 109 W. Bern Street, Reading, Pa.

Export Department: The Carpenter Steel Co., Port Washington, N. Y. — "CARSTEELCO"

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THE WORLD'S STANDARD OF HARDNESS TESTING ACCURACY

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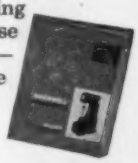
Sensitive and Accurate as a precision balance—the WILSON "Rockwell" hardness tester insures the quality of your products and protects your good name as a manufacturer.

Durable as a machine tool—WILSON "Rockwell" hardness testers withstand severe daily use with a minimum of service requirements.

A staff of WILSON hardness testing experts is available to help choose the model best suited to your job—and provide quick emergency service if it is ever needed.



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What leading magazines say about this book:

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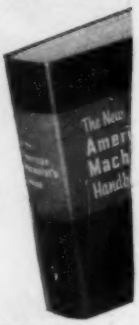
Automotive Industries: "Storehouse of useful tables and formulas, plus . . . methods, materials, and equipment."

THE NEW
AMERICAN MACHINIST'S HANDBOOK

Edited by RUPERT LE GRAND
Senior Associate Editor,
American Machinist

1579 pages, 5½ x 8
774 illustrations, $11.00
Payable in installments



JUST think of being able to find the answer—the dependable answer—to almost any question—quickly—layouts, feeds, speeds, tools, jigs, fixtures, materials, standards, tolerances—any detail of machine shop or drafting room practice. The New American Machinist's Handbook presents this kind of information, in the form in which you can best understand and use it.

Here is a treasury of the kind of machine shop information that will help every man to save time and avoid trouble in his own work, to go ahead on any job with confidence, and to improve his skill, reputation, and earning power.

See for yourself what this modern metalworking guide can do for you. Look the book over for 10 days free. Pay on easy monthly terms if you decide to keep it.

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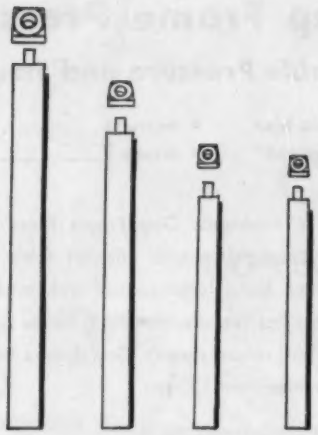
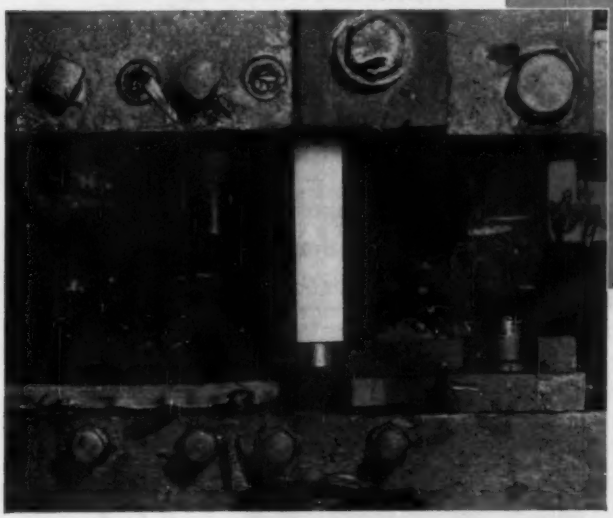
From the *American Machinist* Library of *Tips for Top Shop Men*

IF you have worked with your hands, your normal tendency in a crisis will be to work with your hands again. There are times when this will impress the men who work for you, do much to knock down any idea that you're an incompetent stuffed shirt. But never forget that you're paid now for working with your head, and that headwork demands more perspective than handwork is likely to give you. Also remember the thrill you got out of achievement and give the next generation the same chance to grow.



A-L CUSTOMER FINDS SAGAMORE PUNCHES BEST IN TOOL-COST STUDY



Looking down on the SAGAMORE high speed cold nut punch in horizontal press.

An A-L customer tested various tool steels to determine the best for his varied cold-punching operations. SAGAMORE, a new air-hardening, non-deforming die steel was the ultimate choice. Here's why:

- Using SAGAMORE cold-drawn stock eliminated the need for finish-grinding the punches.
- Punches of SAGAMORE outperformed those of carbon-vanadium steel three to one.

The SAGAMORE punches were hardened by heating in a salt bath to 1750F. and air cooled. They were then given a double draw at 1110F. The resulting Rockwell hardness was 51C.

Characteristics of A-L SAGAMORE are: Excellent non-deforming properties, unusual toughness, lower hardening temperatures, and easier machining and grinding. These, plus the comparatively low cost, make it a good selection for this type of application.

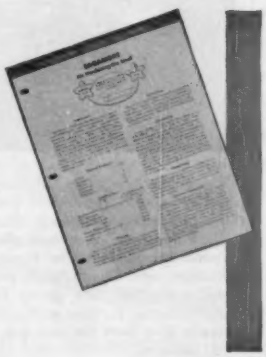
For assistance with your tool or die steel problems, call your local A-L representative or distributor, or write *Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania.*

For nearest representative, consult Yellow Section of your telephone book.

Write for your SAGAMORE BLUE SHEET

This four page report was compiled from data collected in laboratory and field tests. Included is complete information on applications, physical characteristics, forging, annealing, hardening, tempering, etc. *Ask for your copy.*

ADDRESS DEPT. AM-89



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Allegheny Ludlum

WSW 6389

AL® FINE TOOL STEELS SINCE 1854

WILLIAMS-WHITE Hydraulic Gap Frame Presses

With Adjustable Pressure and Stroke

- **Capacity** ..... **100 Tons**
- **Table, R-L, F-B** ..... **96"x54"**
- **Daylight** ..... **30"**
- **Stroke** ..... **18"**

This WILLIAMS-WHITE Hydraulic Gap Frame Press is of steel plate, welded construction with integral table. It is equipped with sensitive hand lever control with latch for holding pressure. Press has two double acting kicker pistons for rapid approach and return speeds. Gap Frame Presses can be built in capacities from 15 tons.

For details, write your nearest WILLIAMS-WHITE representative or direct to us.

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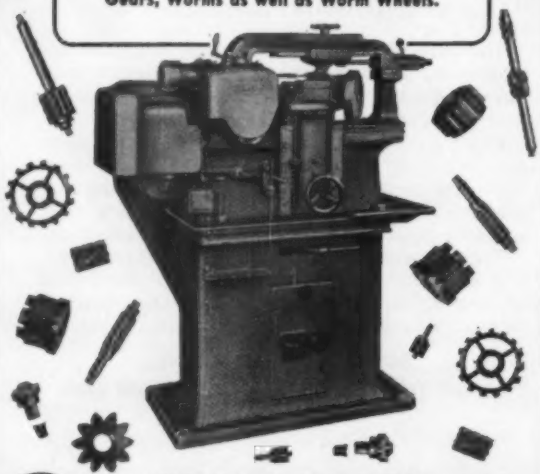

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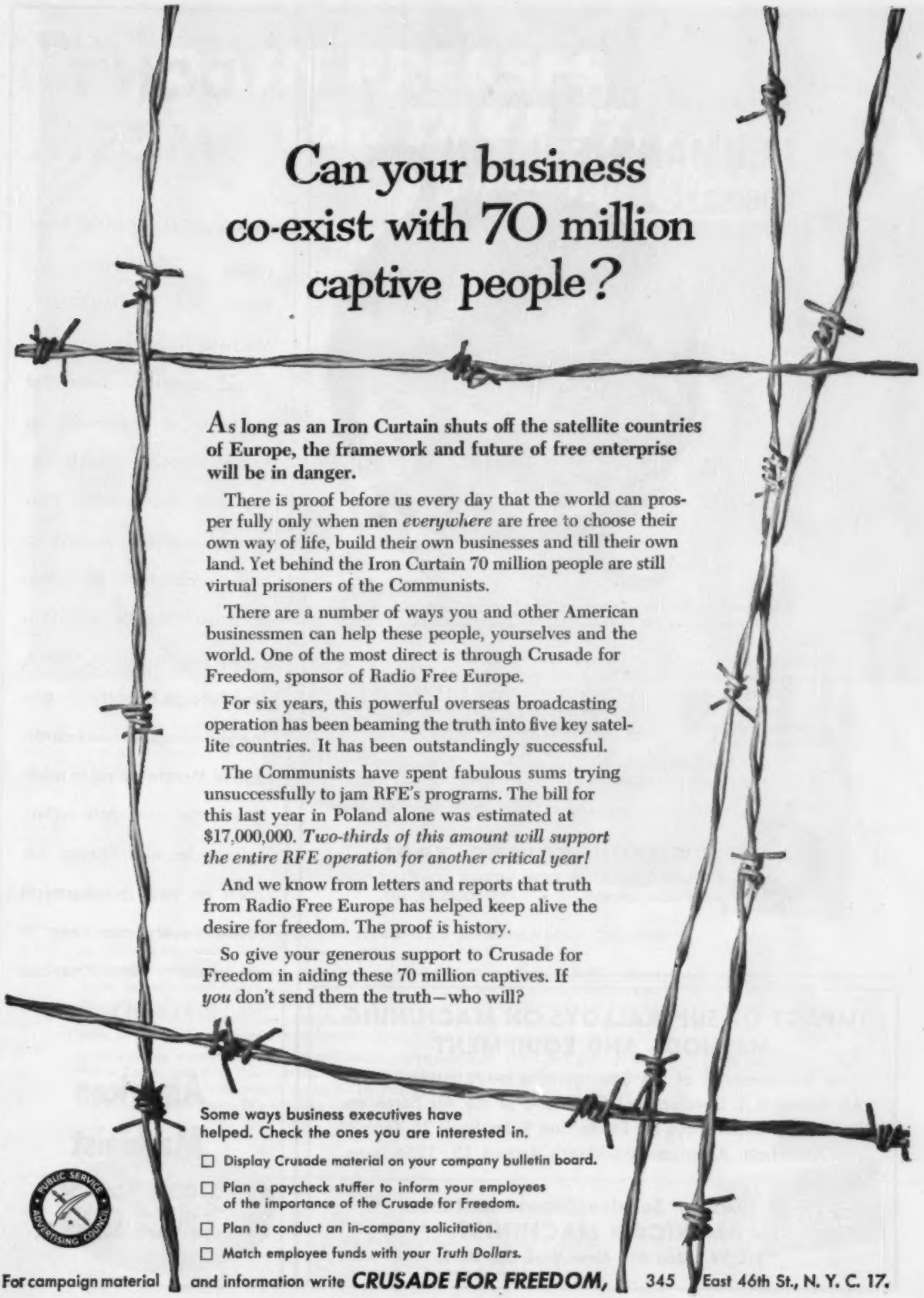

As long as an Iron Curtain shuts off the satellite countries of Europe, the framework and future of free enterprise will be in danger.

There is proof before us every day that the world can prosper fully only when men *everywhere* are free to choose their own way of life, build their own businesses and till their own land. Yet behind the Iron Curtain 70 million people are still virtual prisoners of the Communists.

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For six years, this powerful overseas broadcasting operation has been beaming the truth into five key satellite countries. It has been outstandingly successful.

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Some ways business executives have helped. Check the ones you are interested in.

- ☐ Display Crusade material on your company bulletin board.
- ☐ Plan a paycheck stuffer to inform your employees of the importance of the Crusade for Freedom.
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- ☐ Match employee funds with your *Truth Dollars*.

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IMPACT OF SUPERALLOYS ON MACHINING METHODS AND EQUIPMENT

Here is a summary of the findings of a study made for the Air Research & Development Command of the Air Force entitled "Will Superalloys Set Production Rates Back 25 Years?" reprinted from American Machinist's August 13, 1956 issue. Address:

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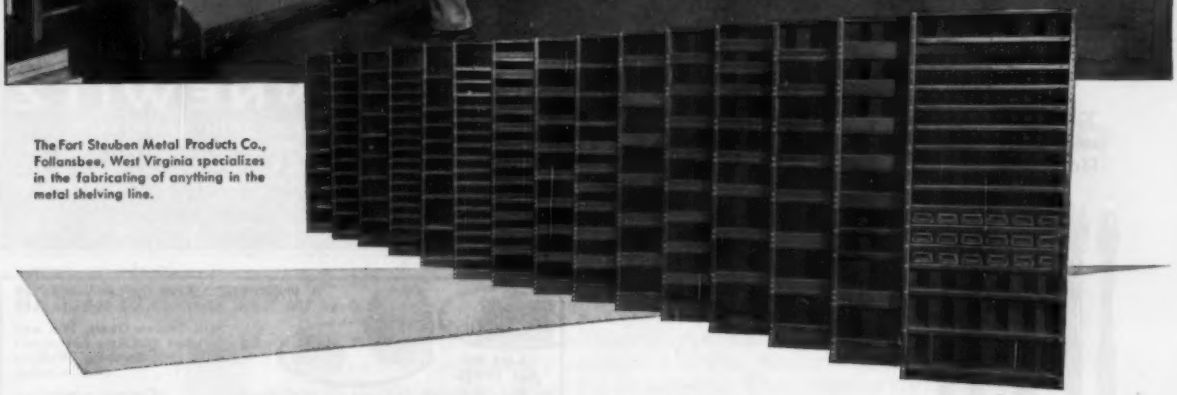

Mr. Albert W. Robinson, Vice President of the Fort Steuben Metal Products Company has this to say about Bath Presses:

"Here at Fort Steuben we are more than satisfied with the way Cyril Bath Presses have demonstrated their ability to take it. Operating as we do, sometimes around the clock to keep up with demand for our shelving, we require dependable, rugged equipment. This ruggedness, coupled with large bed area for dollars expended, plus ease of operation and maintenance makes Cyril Bath Presses ideal."

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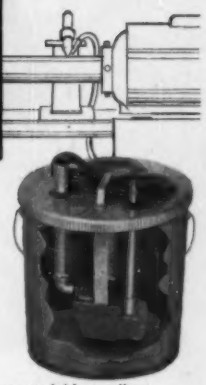

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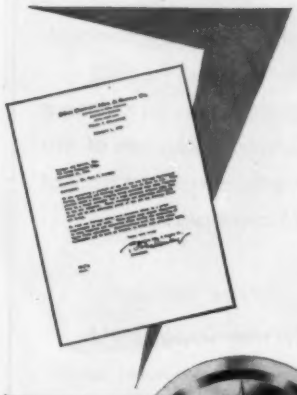

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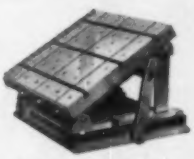
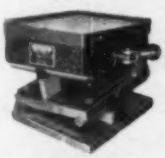
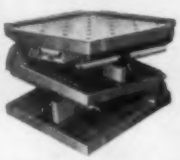


HEAVY DUTY SINE PLATE FOR MACHINING



"MAGNA-SINE" WITH MAGNETIC TABLE



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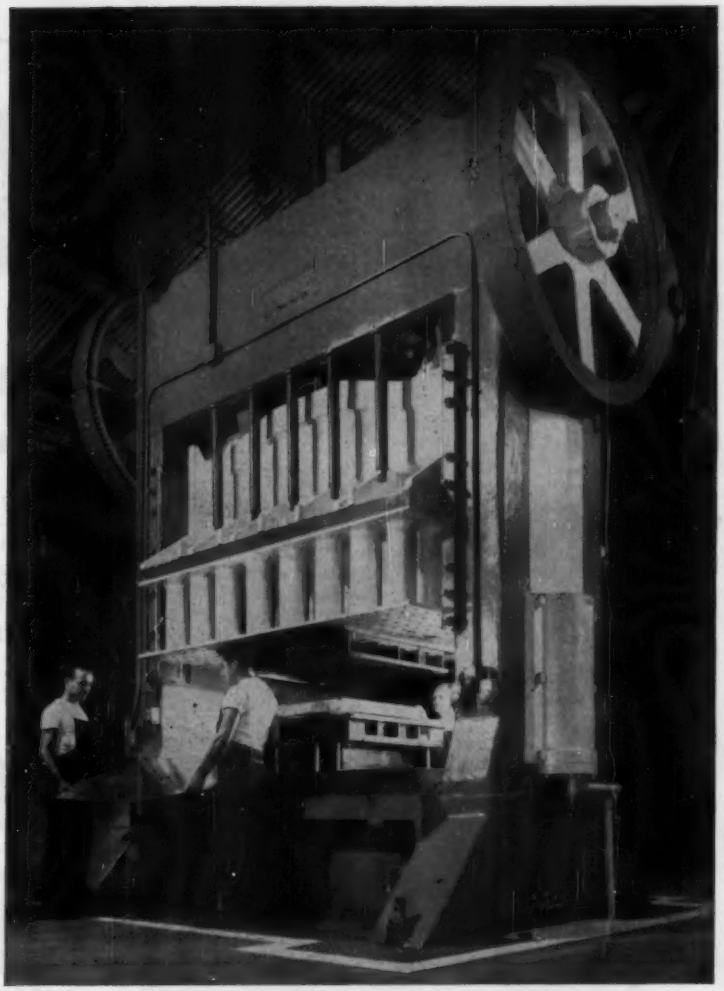
BE sure your machine tools don't spend most of their "working" day as layout tables. A machine tool earns its keep only when it is cutting metal. Jobs can be set up on a surface plate or bench by someone else—frequently someone better at setup than the machine operator.

Cleveland Press speeds production at International Metal Products Company

famous **arctic circle**
air cooler parts completely formed
in just one stroke!



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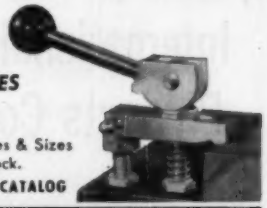

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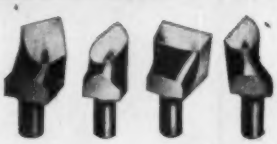

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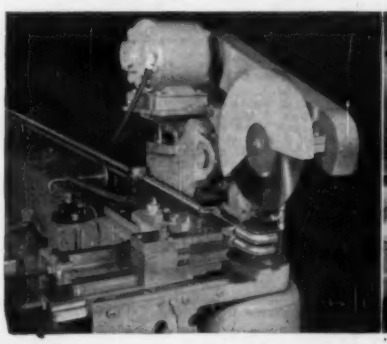

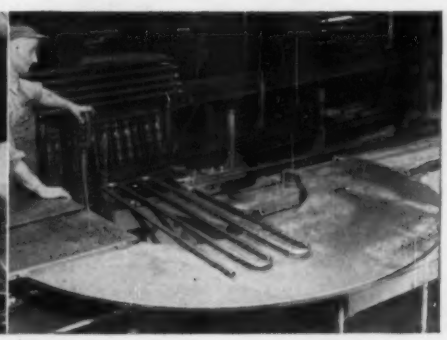

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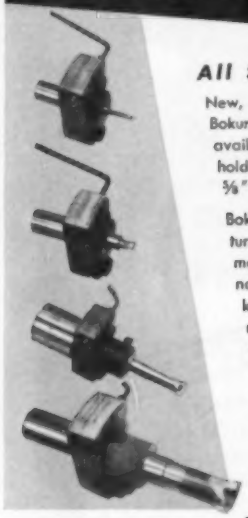

All Sizes for All Machines

New, precision-engineered Tool Holders for Bokum Boring Tools are now immediately available from stock in eight models . . . with holder shank diameters ranging in size from ⅝" to 1¾".

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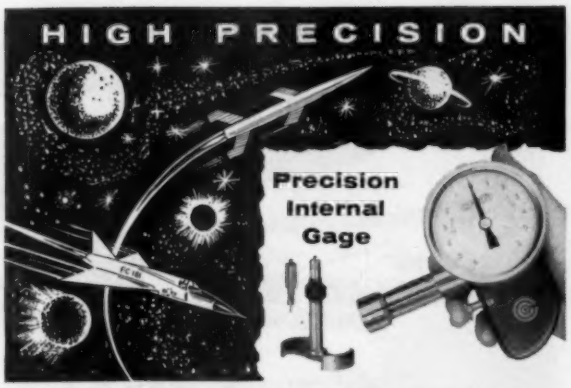

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- Indicates actual size, a fixed — not passing — reading.
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- Positive 2-point gaging — automatic centering.
- Assured accuracy regardless of who operates it.
- Shallow holes, deep holes, inside splines, open-end holes gaged easily.
- Detects ovality, back or front taper, bell mouth, barrel shape.
- Reaches to bottom of blind holes.
- Will gage work in the machine.
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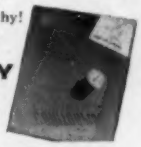

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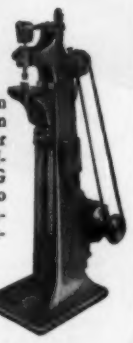

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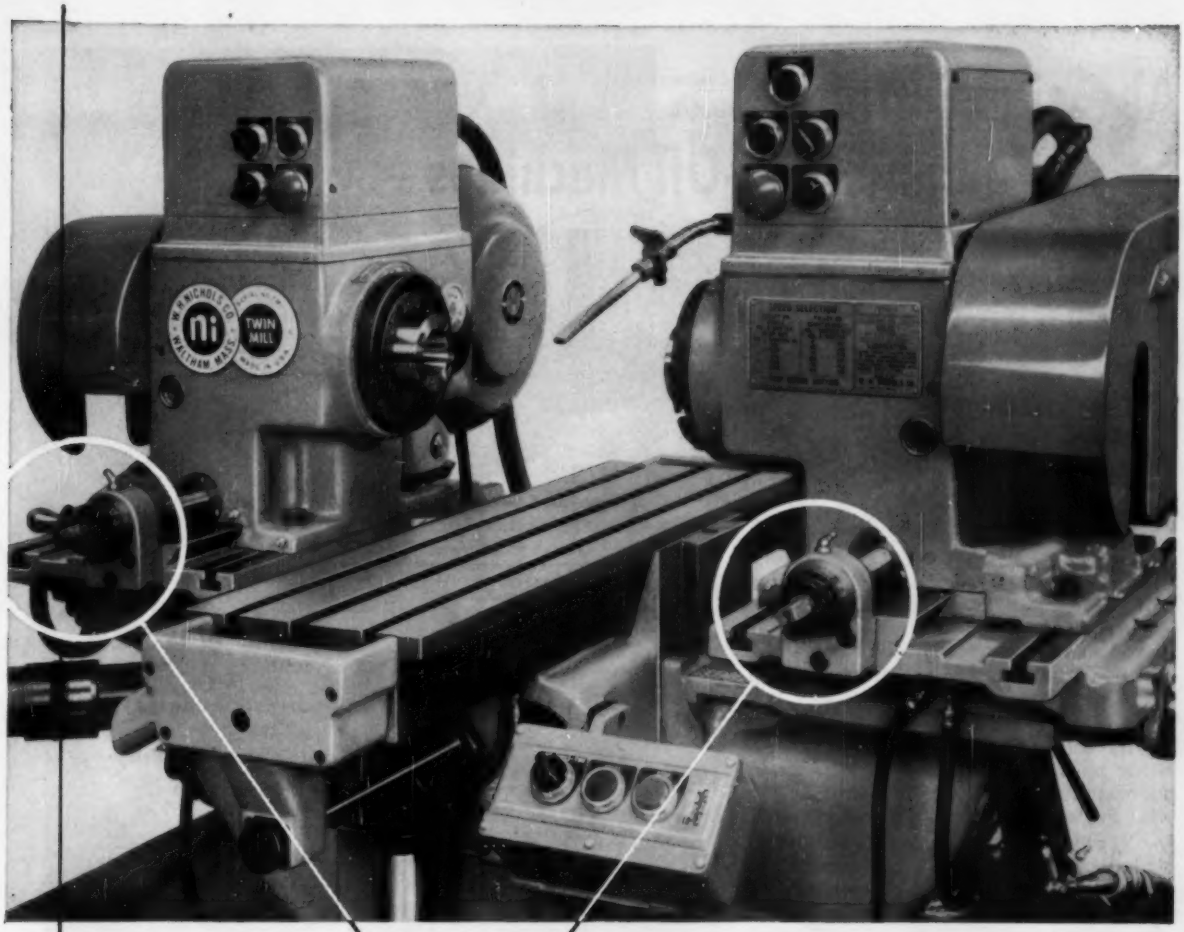

NICHOLS TWIN MILL . . . SOMETHING NEW HAS BEEN ADDED

Now, the Nichols Twin Mill offers dovetail slides with micro-feed screws for *longitudinal* adjustment of milling heads, as well as transverse and vertical screw adjustments. With this new feature, the Nichols Twin Mill provides **Six-Way Adjustability for Each Milling Head in Seconds.**

Adaptable for long or short-run jobs. The scope of Nichols Twin Mill utility is limited only by the imagination of the user.

THINK: Two geared milling heads—each completely independent with independent drives, push button controlled. Wide range of spindle speeds—55 to 2050 R.P.M. Vertical Head available for either or both spindles. Automatic Table cycle with rapid approach, hydraulic-controlled variable cutting feed and rapid return.

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Model 265 • hydraulically-operated with capacity to cut 2" dia. solid, 4" tubing.

Model 302 • horizontal wet abrasive cutting machine for flat or irregular shapes.

Model 406 • high speed machine with capacity to cut 6" dia. solids in seconds.

Model 476 • fully automatic wet abrasive cutting machine with capacity to cut 6" dia. solids.

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Model 509 • rotary oscillating hydraulic wet abrasive machine. Cuts material to 9" dia.

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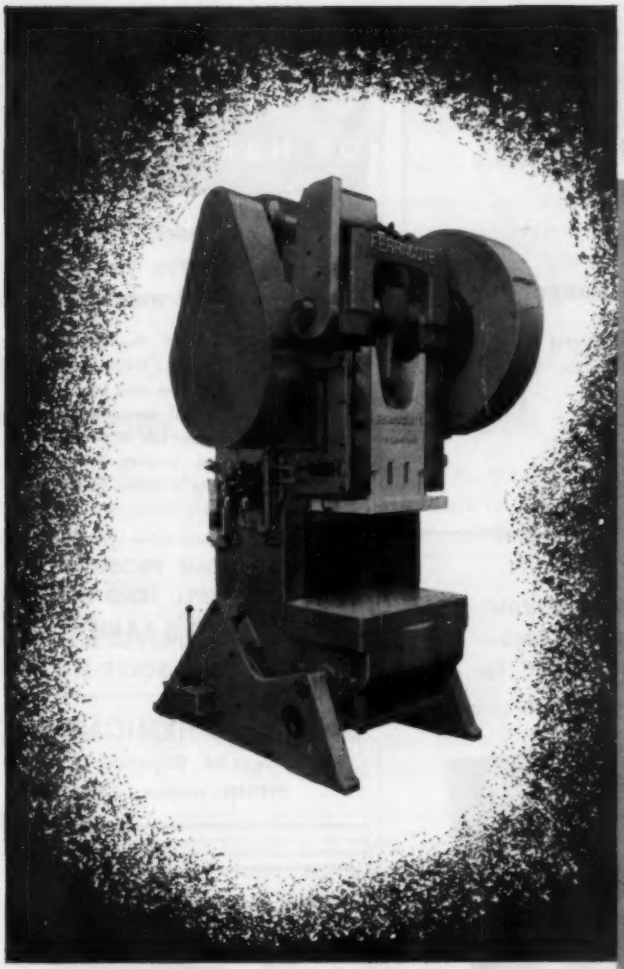

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MOORE SPECIAL TOOL COMPANY

Holes, Contours, Surfaces

Published in the interests of greater accuracy and quality in the toolroom and on the production line by the Moore Special Tool Co., Inc., 738 Union Ave., Bridgeport 7, Conn., builders of Jig Borers, Jig Grinders, Panto-Crush Wheel Dressers, Precision Rotary Tables, Motorized Centers and a complete line of Hole Location Accessories.

Why you should use the Jig Borer and Jig Grinder to inspect their own work

In more than 90 per cent of all cases, the Moore Jig Borer and Jig Grinder provide the most accurate and efficient means for inspecting their own work. The advantages include:

1. Considerable saving of time results from checking the piece in the original setup, *while still in the machine.* In addition, should an error be discovered—the work is *in position* for correction.

2. The same directness which reduced sources of locational error in comparison to toolmaker error also reduces the number of steps and sources of error in inspection.

3. The machine's measuring system is fully as accurate as *any* standard that might be used in its stead. The inspection values, determined by means of this system, are likely to be *more* accurate than those attained by any other shop standard because reorientation errors are eliminated.

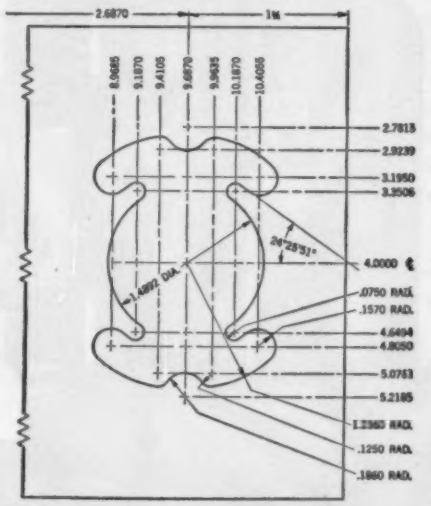
4. The machine spindle provides a rotatable mounting for an indicator. Holes can be picked up directly in this manner, without use of plugs or pins. Out-of-roundness, often mistaken for out-of-location, is easily detected and identified. Full 360° rotation of spindle provides a double indicator reading of any error, thus increasing readability. By vertical movement of the spindle and indicator the shape of the hole can be explored, revealing taper, bellmouth or barrel shape.

5. Contours, one of the most difficult, time-consuming jobs of inspection, can be rapidly and accurately measured and inspected by use of the "indicator measuring" technique. The drawing at the right shows dimensions to be inspected on a complex contour. Of this job it might well be said, "How *else* would you inspect it?"

6. Work jig bored or jig ground to *polar* coordinates on the rotary table can be inspected to *rectangular* coordinates in the same setup. This not only provides a check on possible errors in settings; it eliminates sources of rotary table errors.

7. Paradoxically, the machines will actually inspect somewhat more accurately than they will locate, under most conditions. During inspection, both machine and work are free of vibration, stresses and temperature differentials, so that the accuracy of the measuring system is undiminished.

8. A microscope, interchangeable with the indicator in the machine spindle, can pick up surfaces and small holes which cannot be conveniently reached with an indicator point.



Without modern methods, this contour presents a serious problem to inspect as well as to machine.

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The information on this page is just a sample of the valuable, on-the-job aid you can get from Moore's *all-new* book, HOLES, CONTOURS AND SURFACES. Tells you how to produce tools, dies and precision parts *the modern way.* 424 pages, 495 illustrations. 184 pages of Woodworth Coordinate Location Tables from 3 to 100 holes. Price only $5 in U.S.A., $6 elsewhere. Send check or money order to Moore Special Tool Co., Inc., 738 Union Ave., Bridgeport 7, Conn.

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—Cross	15"
Vertical Capacity	23"
Throat	20"
Weight	

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Gaging . .

the Surplus Machinery Market

Business at the moment can be classified as anywhere from "soft" to "dead." This, of course, comes as no surprise to anyone. A late spring and summer slump is traditional.

But what about the outlook for the rest of the year? Dealers in the Midwest and on the East Coast for the most part are convinced that come fall the used machinery business will snap out of its lethargy and 1957 will wind up as a "very good year."

Not so out on the West Coast, however. There, business has been extremely slow for the last month or two. There's no indication of either a price rise or cut in the near future. A few small dealers may resort to price cutting soon, but if that happens, it will be a desperation step. Sales are off generally about 15% in the last couple of months, and most West Coasters don't see much hope for a big pickup in the fall.

While it's hard to put your finger on the exact cause for the slowdown in sales, several factors contribute toward it: (1) tight money, (2) increasing tendency of buyers to purchase used machines at auction at prices higher than the dealers can afford to pay, (3) increasing tendency of the Armed Services to hold more and bigger auctions, and (4) the difficulty in finding the quality of machines that customers want. The tax bite on corporations, too, is causing a sales slowdown.

Many dealers also report that they are consistently losing sales to the "new" market. Price differentials between top used machines and comparable new ones are not yet great enough to send prospective buyers scurrying to used dealers' showrooms.

Speaking of prices, one dealer has them figured out this way: prices of medium-age machines (8 to 17 years) should stay just about as they are in the foreseeable future; newer machines could show a 5% increase soon; and prices of older machines will start to drop slowly in the near future. Another dealer (he's the exception, not the rule) foresees a 10-15% jump in used machinery prices over the next six months or so.

Items in hottest demand out on the West Coast, where the aircraft industry and its subcontractors rule the Metalworking roost, are press brakes and shears, light vertical millers and good heavy milling machines, particularly high-speed ones. Anything good in the way of used machines, as usual, is in short supply.

But while dealers are in the summer doldrums, the auctioneers are cleaning up. Not only the private ones, but the various Armed Services. In fact, some dealers contend that until a major auction or two finds the going rough and bids drop, the used machinery dealer's life won't be a happy one.

Auctions are drawing such large crowds and such high bids today that if a dealer approaches a potential buyer for a particular type of tool during an auction, more often than not he gets the brush-off from the buyer, who prefers to buy direct and save on commissions. Chances are it's that same buyer who'll pay the earth for some machine tool he's had 10 minutes to examine just before the auction. And because he buys the tool as is, he has no recourse except to the crying towel if he finds himself stuck with a lemon.

Nowadays you'll find more and more people like that and fewer and fewer dealers at any major auction. Bids being what they are today, the dealer can't touch most prices and turn around and sell the tool "as is" in his shop at any kind of a profit—let alone rebuild it and slap a guarantee on it.

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INGERSOLL 42" x 42" x 14' Adj. Rail Dbl. Housing — Tubular Ways — 2 Swivel Side, 2 Swivel Rail Heads

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1 spdl. 24" sw. #3MA4 Avey, new 1942
1 spdl. 26" sw. #4MS L-G hydraulic
2 spdl. 24" sw. #3 Avey, AC MD
3 spdl. 20" sw. #2LMS L-G, 1942
3 spdl. 24" sw. #3MS L-G, new 1943
6 spdl. 20" sw. #1LMS L-G, new 1943
16 spdl. Fox #K60H, #2 taper, 1944

GRINDERS

3"x12" #5 B&S, 1942
3"x18" #5 B&S, 1943
6"x18" #4H Landis, new 1942
6"x18" Norton Type C, new 1943
10"x18" Norton Type C, new 1941
10"x36" Norton Type C, new 1942
10" (18" sw.) x 48" Cinn. ER, 1943
10"x36" Hill-Clarke, AC Mot. Dr.
10"x72" Hill-Clarke, AC Mot. Dr.
10" x 72" Norton Hydr. 1944
10"x96" Hill-Clarke, AC Mot. Dr.
16"-20"x36" Norton, angular wheel
14"x40" #3 B&S Univ., 1943
14"x72" Norton Type C, new 1941
16"-20"x96" Norton, 1942
16"-40"x96" Norton Gap, 1942
16"x72" Hill-Clarke, AC Mot. Dr.
16"-36"x72" Norton, AC MD 1941
18"x120" Norton, AC MD
20"-32"x144" Norton Pl. Cyl.
23"x36" Norton, Hi-Swing
24"x264" Norton, AC MD
42"x72" Norton, extras, new 1947
#3A Bryant Internal, new 1942
#16A-16 Bryant Internal, new 1943
#16-36 Bryant Internal, new 1941
#24-26 Bryant Internal, new 1941
#24-36 Bryant Internal, new 1941
#72A3 Heald Int. Sizematic, 1944
#72A5 Heald Univ. Int., 1942
#72A5 Heald Internal, new 1942
#72A5 Heald Bridge Type Int.
#18-30" Blanchard Rot. Surf.

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16ML-16"x36" LeBlond Auto.
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24"x42" Fay Auto. AC MD
30"x126" Putnam Grd. Hd., MD
R14 Seneca Falls, 16"x36", 1942
120"x96" cc N-B.-P. ser. 3380
#3W Cinn. Acme Univ. Turret
#4 Gisholt Univ. Tur. A.C.&B.F.
#3H-10 Libby H.D. Tur. 1943
#4A W&S Turret Ser 338949
4FU Fastermatic, tur. 38" sw 1944
8D Potter & Johnston, new 1941

MILLERS

54"x30"x18" Ingersoll Slab, 1954
54"x60"x8" Ingersoll Openside, 1943
Davis & Thompson Vert. 1944
#12-B Pratt & Whitney Profilers
10"x60" P&W Mod. B Thread Mill
#LT 6"x12" L-B Thread Mill
#HT 12"x24" L-B Thread, 1943
#CT 24"x36" L-B Thread, 1943
#118 Van Norman Prod. 1942

PLANERS

60"x48"x27" American, 4 hds.
60"x48"x30 Hamilton, 4 heads

MISCELLANEOUS

36" Rockford Hyd. O.S. Shaper, 1950
Z26 DuALL Zephyr El-Sod. Saw, 1943
15 Ton—60" Colonial Vert. Broach
6" Goss & DeLeeuw 3 spdls. 1941
#306 Barnes Vert. Hone, new 1942
#11RD 2 Hd. W&S Tapper, latest
#36BM G&E 3 Spdl. Bevel Gear
612-A Fellows Gr Shaper 18" cem
#HRS Barber-Colman Sharp Mach
No. 2 Pfauter Gear Hobber

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GRINDERS, No. 36 Hanchett Vert. Rotary, 44
36" x 42" P. & W. Vert. Surf., '47
60" Hanchett Vert. Spin. Surf., No. 300
10" x 20" B. & S. No. 1 Univ., 1942

LATHES, 36" x 21' cen. N.B.P. Grd. Hd., T.A.,
25" x 48" cen. LeBlond, 31" sw., '41
16" x 78" cen. Sidney, T.A., 18½" sw., 1952

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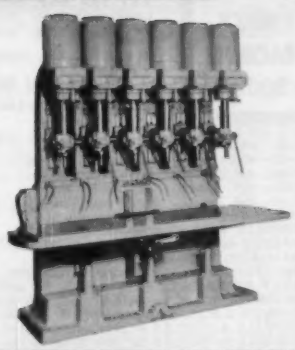

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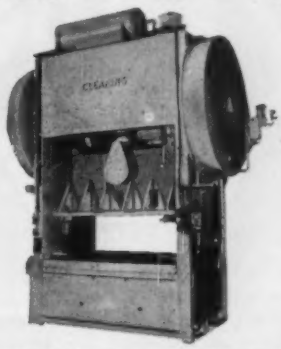

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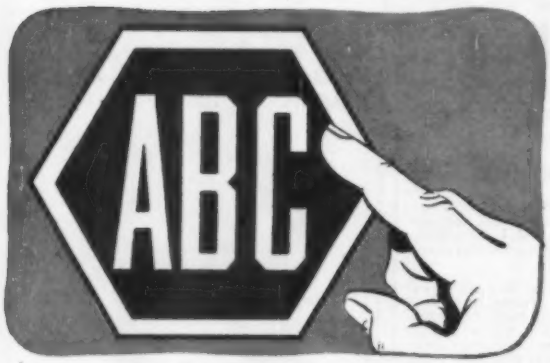

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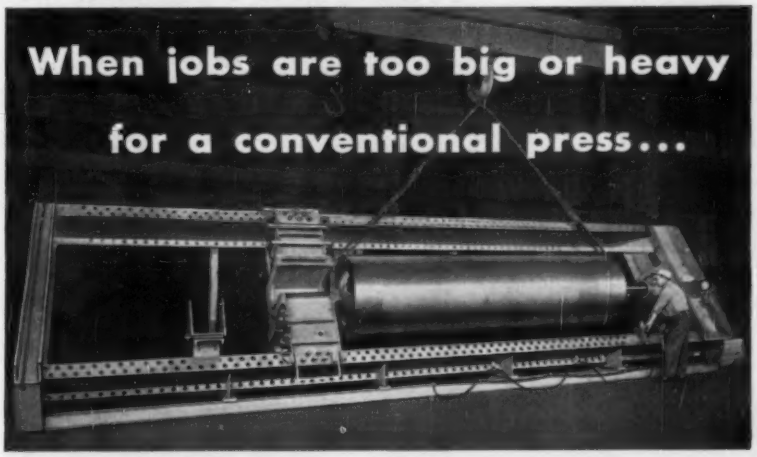

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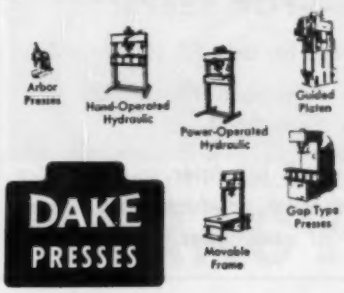

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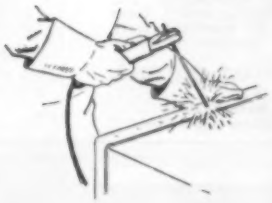

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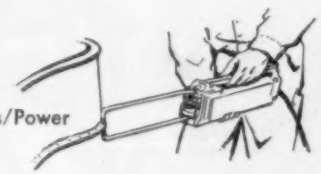

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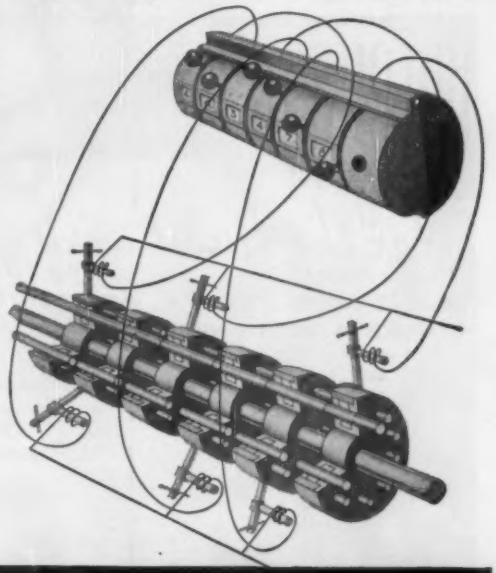

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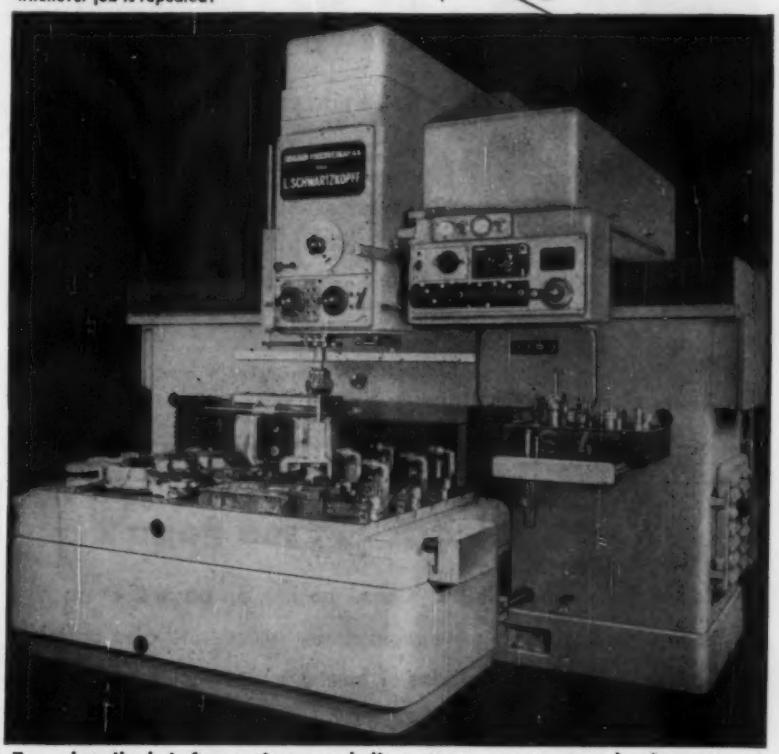

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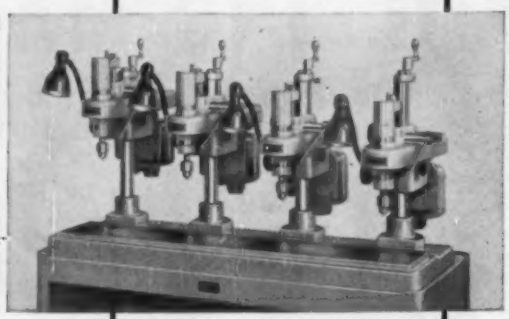

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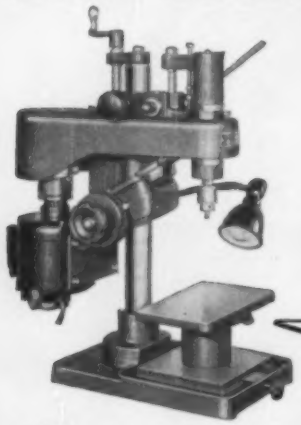

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330 W. 42nd St., New York 36, N. Y.

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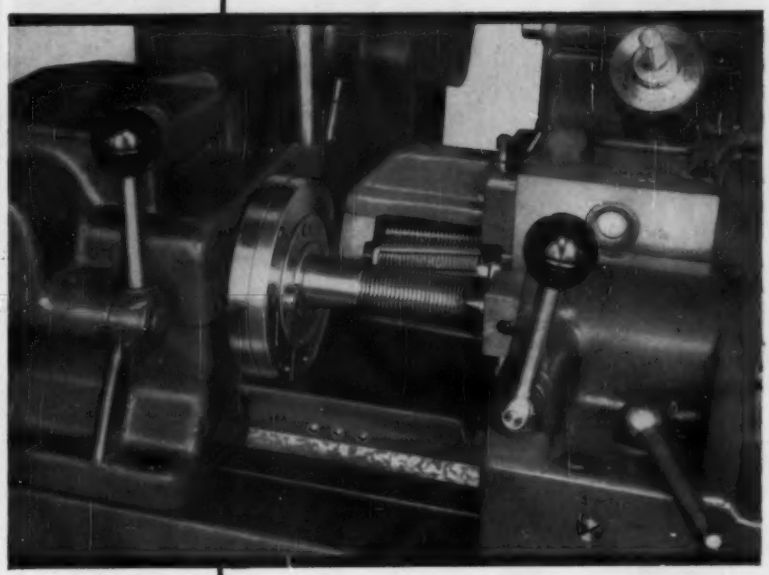
ONE GOOD TURN



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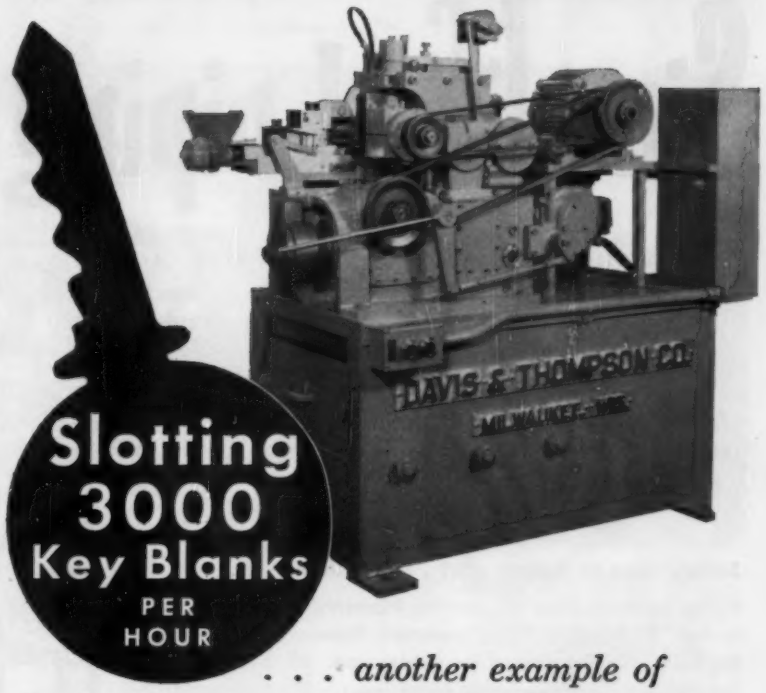

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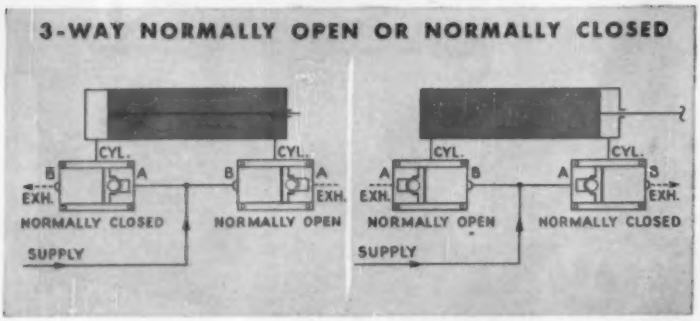
Simplified piping

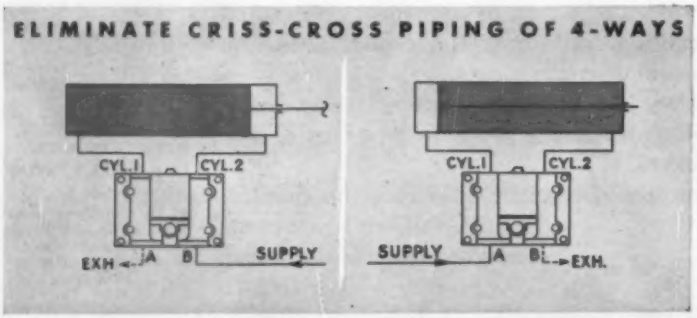
Another *Plus Value* in NOPAK-MATIC poppet-type air control valves



Simply pipe to proper port . . . no change in valve necessary

Piping supply to Port "A" provides Normally Closed operation — supply to Port "B" Normally Open operation. There are no changes to make in the valve . . . just pipe to the proper port. All 3-Way valves have two cylinder outlet ports for piping convenience.

The exclusive Nopak-matic "Flow-Director" pilot head automatically selects pilot pressure from whichever port is used as inlet. It eliminates purchasing special valves for each application or re-assembling of parts.



Simply pipe to proper port . . . no change in valve necessary

All Nopak-matic 4-Way valves can be piped with pressure to Port "A" or Port "B". Here again, the "Flow-Director" pilot head automatically selects pilot pressure from the inlet port. Flow through the valve is thus changed to meet the application requirements . . . eliminates criss-cross piping to the cylinder. There are no changes to make in the valve . . . just pipe to the proper port.

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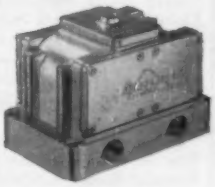

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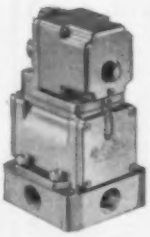
Master Valves



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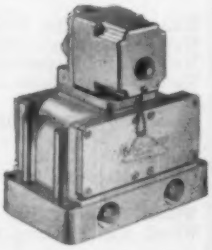
Pilot Operated



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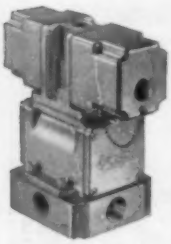

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Double Solenoid
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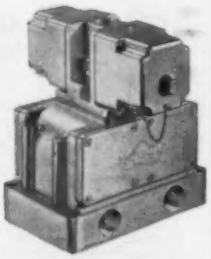

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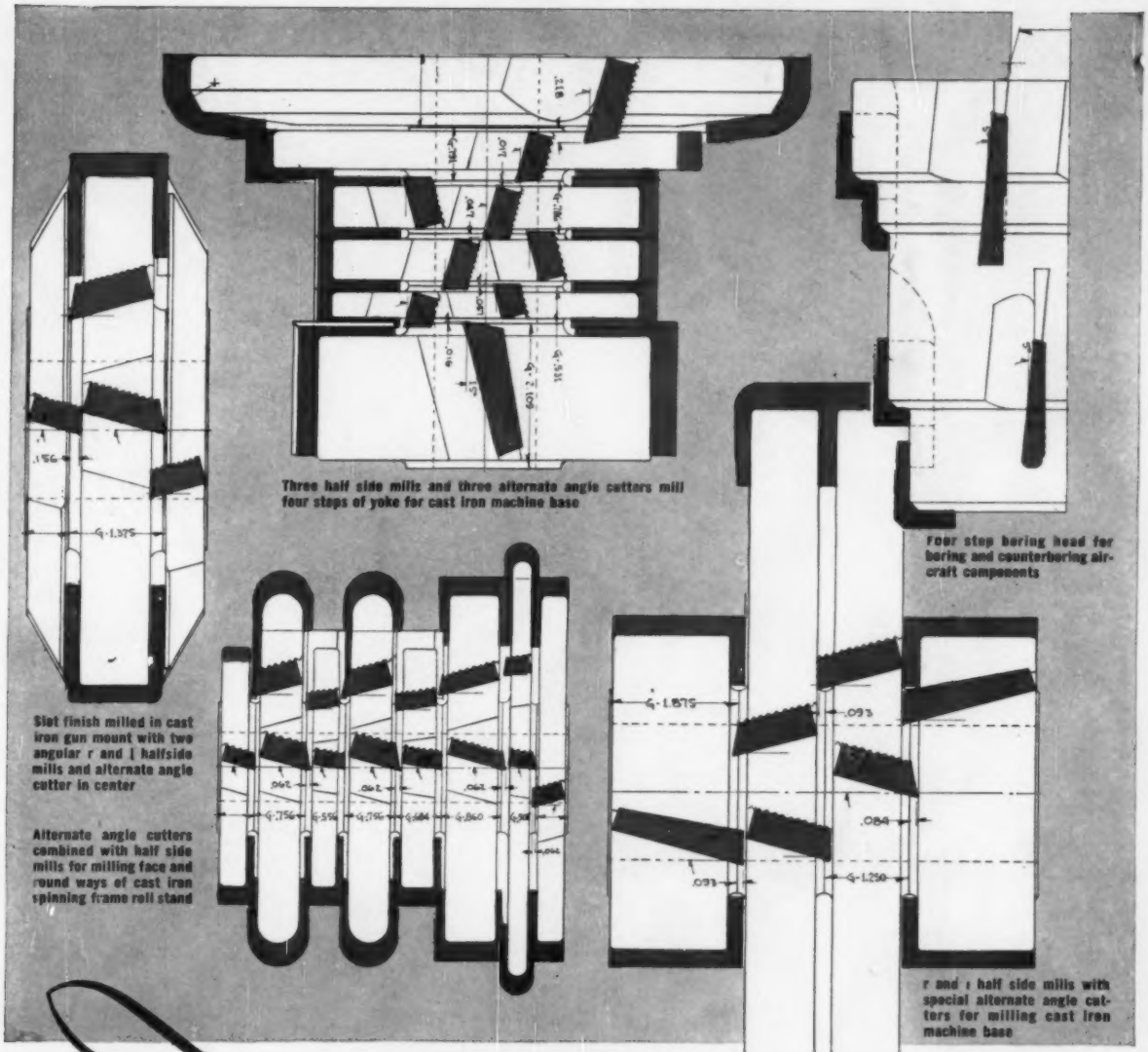
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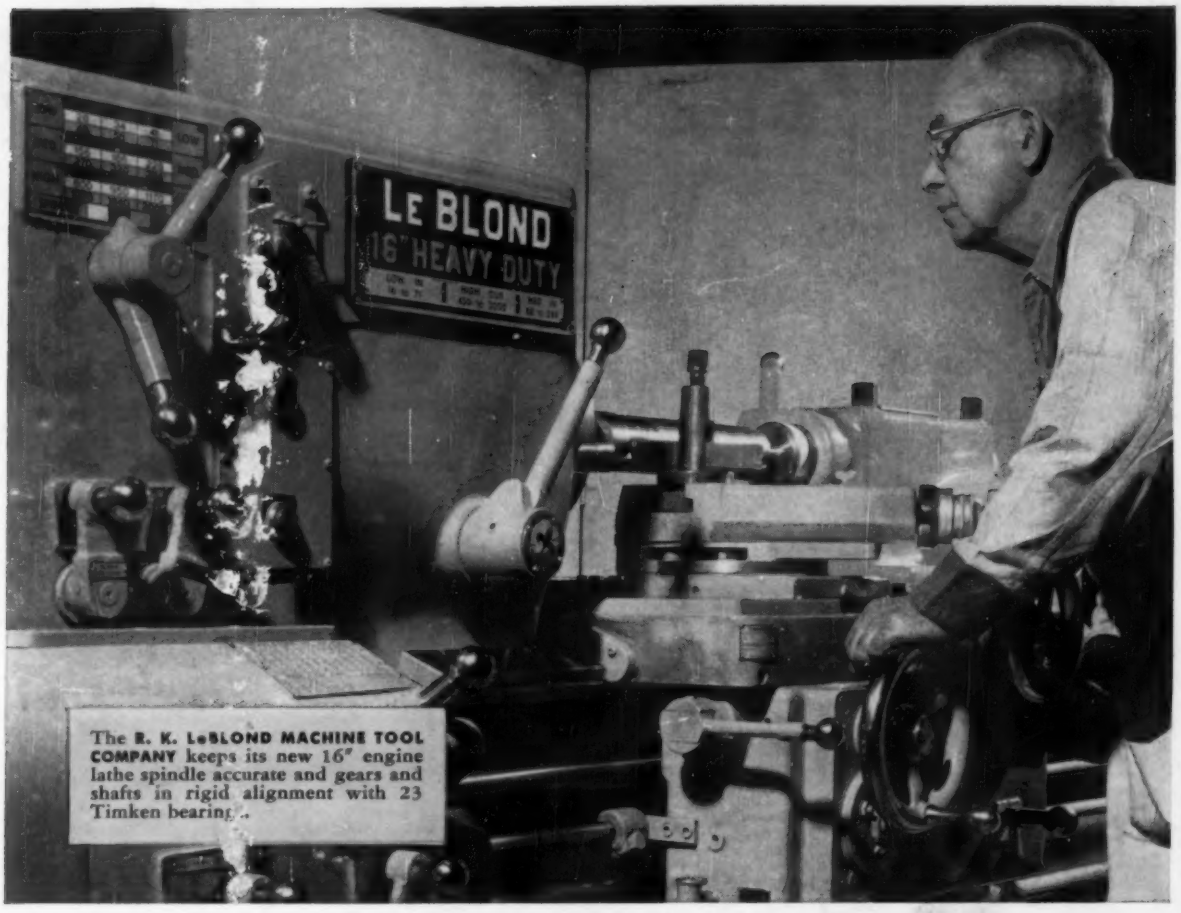

The R. K. LeBLOND MACHINE TOOL COMPANY keeps its new 16" engine lathe spindle accurate and gears and shafts in rigid alignment with 23 Timken bearings.

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